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TROPICAL DISEASES BULLETIN

IMPERIAL INSTITUTE
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Vol. 3. 1914. No. 7.

SANITATION NUMBER.

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TROPICAL DISEASES
BUREAU.

General Editor:
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COMMONWEALTH MYCOLOGICAL INSTITUTE
26 MAY 1971

London:
TROPICAL DISEASES BUREAU,
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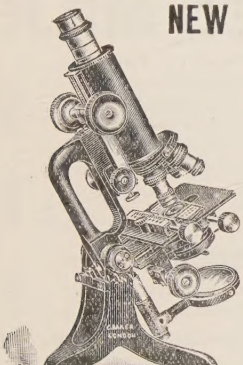

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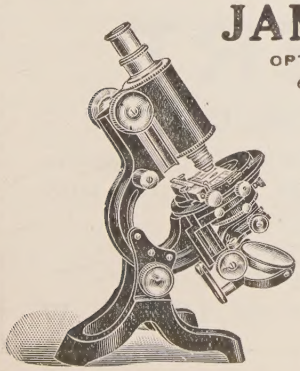

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TROPICAL DISEASES BUREAU.

TROPICAL DISEASES BULLETIN.

Vol. 3.] 1914. [No. 7.

APPLIED HYGIENE IN THE TROPICS.

By Colonel W. G. King, C.I.E., I.M.S. (Retired).

REPORTS.

Southern Nigeria.

*The estimated population is 8,248,536. The death rate of European officials, who numbered 2,068, amounted to 11·12 per mille. In Lagos the death-rate of the general population was 29·9 per mille, as contrasted with 37 in 1909, 35.8 in 1910, and 30·7 in 1911. Infantile mortality was at the rate of 225·3 *per mille* of births!

The prevailing diseases are malarial fever, dysentery, tuberculosis, and ankylostomiasis. Leprosy, filariasis, and blackwater fever are also found.

In the Eket District, 149 cases of a mild form of human trypanosomiasis were found; pigs and dogs were also found infected with trypanosomes. In pigs the disease is "particularly fatal," whilst in human beings the tendency to cure is pronounced, and it "does not apparently assume an epidemic form." Dr. Foran is quoted to the effect that the disease has existed in the District for "perhaps centuries," and that formerly natives enforced their own laws, requiring segregation of the human being. There has now been established an isolation camp, ten miles from Eket. Here fly-proof sheds have been provided. In the "why and wherefore" of this mildness in attack or, say, the comparative immunity of the native to this form of trypanosomiasis, those investigating sleeping sickness may, we suggest, find matter of interest either in epidemiology or therapeutics.

The London School of Tropical Medicine was able, as a result of investigation by Dr. Leiper, to add to its list of scientific successes in the identification of *Chrysops dimidiata* and *C. silacea* as being the intermediate host and carrier of *Filaria loa*.

*Southern Nigeria.—Annual Medical Report for the Year ending December 31st, 1912. [Principal Medical Officer, W. H. Langley; Senior Sanitary Officer, Arthur Pickels.]—134 pp. f'cap. 1913. Printed by Waterlow & Sons, Ltd.

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Sanitary Works.

The total expenditure on sanitary works amounted to £14,068. To this might be added £8,384 expended for laboratory purposes in the interests of sanitary research, and the sum of £920 from Native Court Funds for general sanitation. Taking the available figures of gross public expenditure as recorded for 1910 (viz., £1,592,282) this would represent 1·5 per cent. on account of sanitary advance, which contrasts favourably with the proportion allotted in the neighbouring colony of Sierra Leone.

The amount quoted against sanitary works was expended by the Public Works Department on drainage, reclamation, excavation, and mosquito-proofing. No details are given in the Report of the particular methods employed or the physical results achieved; nor is it specifically stated in what particular areas the improvements were made. Were such information supplied, and the dates of the works added, it might be possible to gauge their anti-malaria value by the mosquito or splenic indices which are duly afforded for various localities. This portion of the Report leaves the impression that there is an absence of that co-operation of the Public Works Department with the Sanitary, which makes for success and economy in applied hygiene. The wider view that must be taken of public matters under the new regime, following the union of Northern and Southern Nigeria (administered by a Governor-General), will doubtless favourably affect this subject. The absence of very close community of efforts between the sanitary and engineer authorities, for example, in connection with the present assembly of labour for the new Nigerian Railway, might be fraught with losses affecting both life and finance.

Prison Hygiene.

On the sanitary condition of prisoners, the Senior Sanitary Officer makes the following statement:—"Considerable work has been done to render the general sanitary condition of many of the prisons more satisfactory. There is no doubt that much improvement has been brought about; yet it will be observed that in some instances the ventilation area per prisoner is very greatly below even the lowest standard which can possibly be adopted." On referring to page 130 of the Report, there is found a table giving "the average cubic space per cell per prisoner," "average ventilation area in cells per prisoner" and "average prison area per prisoner." To quote figures under the last item doubtless has at times its sanitary utility; but, as there is nothing to show whether the square area of gardens, guard and other adjunct buildings are included or excluded, they are of little value. The cubic space column reveals such inadequate amounts as 215ft., 172ft., 217ft., 104·7ft., 164ft., etc., per head. As the square cell area available is not quoted, it is possible that in practice, with reference to "available" air-space in relation to height, conditions may be better or worse than those figures show; and it would therefore be desirable in future returns for figures as to cell square area to take the place of the first column (Prison area) or to supplement it. As they stand, however, the figures fully support the Senior Sanitary Officer's advice that improvement should be given effect to at an early date. By way of comparison, it may be said that out of 45 prisons quoted in the Table, only six possess the very moderate standard of cubic space

allowed by the Government of India for Indian prisoners in healthy non-malarious districts; only one reaches the standard allowed in an unhealthy district.

Anti-malarial measures.

The mosquito indices, in 1912, of certain inhabited areas compare favourably with those of 1911. Thus in Lagos and Ebute-Metta the indices declined from 13·1 to 5·04. For the whole province the decline was from 11·1 in 1911 to 5·06 in 1912. This may be in some measure the result of anti-mosquito measures; but, on referring to the Report of 1911, it is found that, if the meteorological results for localities there mentioned be compared with the same for 1912, in Brass only was there more than equivalent rainfall. In the remaining five areas, the rainfall of 1912 was in the total 47 per cent. less than that of 1911; a factor which may have largely influenced the favourable result. In the course of anti-malarial work, there were 794,060 "houses inspected"—a phrase probably implying not a single inspection of each house, but the total number of times certain houses had been inspected. Consequently, when it is stated that in 40,245 instances "houses with larvae" were found, the deduction that only 5 per cent. of the premises held larvae does not convey much information as to the extent of persistent sin in this respect in certain of the total.

In the whole Province, nearly 2,813 acres were cleared of grass as an anti-malarial measure. Remarkably little attention was given to "oiling." Although the 19 men employed on this duty for the whole Province in 1911 had been increased to 47 in 1912, the oiling of pools and excavations amounted to only six more in the latter than in the former year, whilst the drains oiled were less than twice the number; but here, again, the question of repetition confuses the issue as to the actual number of drains attended to. The Senior Sanitary Officer deprecates the slow progress made in mosquito-proofing of houses, and adds (apparently referring to public quarters), "as yet neither sanitary officer has been provided with an opportunity of practising what he preaches on this matter."

The Lagos Municipal Board are obviously exhibiting less energy in mosquito reduction than might be anticipated, having regard to the efforts made under Sir Wm. MACGREGOR, and to not only still existing malaria but the recent presence of yellow fever, for in this connection the Senior Sanitary Officer states:—"In Lagos itself there are about 500 wells. 101 are public and are maintained by the Lagos Municipal Board, but only 19 of these are mosquito-proof." [!]

SIERRA LEONE.

*(1) *Medical Section.*—In Freetown continued anti-malarial measures show influence, as judged by dispensary statistics. In 1910, the malarial fevers treated numbered 1,207. They declined in 1911 to 1,056, and in 1912 to 967. In the Protectorate there were eight cases of blackwater fever and three in Freetown. Notwithstanding the presence of plague and yellow fever in the neighbouring French possession, there were no attacks in the Colony. Quarantine measures were employed against both

*SIERRA LEONE.—Annual Report on the Medical Department for the Year ended 31st December, 1912. [(Acting) Principal Medical Officer, J. W. COLLETT; Senior Sanitary Officer, R. H. KENNAN].—88 pp. f'cap. With photographs, charts and plans. 1913. Printed by Waterlow & Son, Ltd., London.

diseases. Twenty cases of smallpox "were reported" and 122 cases of yaws. In the presence of defective reporting, these figures probably are incomplete.

There were 230 European officials; the invaliding rate was 17·3 and the death rate 17·3 per mille.

The death rate amongst natives in the Colony was 17·7 and the birth rate 14 per mille. In Freetown the death rate was 22·1 and the birth rate 17·62. The total deaths of infants in Freetown decreased from 471 in 1903 to 268 in 1912.

In the gaol hospital, in October, there were 32 cases of beri-beri with 4 deaths, 20 cases remained in hospital at the end of the year. "Uncured" native rice was employed.

In the Koinadugu district at Kaballa goitre is "extremely common." In one native town, where "latrine bush" occurs on both sides of the stream used for the water supply, almost one quarter of the inhabitants appeared to have enlarged thyroids from definite goitre. "Two cases of leprosy and Madura foot respectively were found on patrol." Yaws is fairly common. Three cases of "suspicious trypanosomiasis" were reported on.

This section ends with a note by Dr. J. W. Collett, in which, whilst recording no imported yellow fever, he points to the importance of possible atypical and autochthonous cases, and quotes apparent instances reported by himself and Dr. McConaghy. He urges the necessity for detailed enquiry—not by a hasty Commission, but by an expert who would reside several months in a native town, gain the confidence of the population, and thus secure access to material.

(2) *Sanitary Section.*—During the year, the Freetown Municipality was relieved by Government of the task of scavenging, sanitary inspection, and building inspection and regulation, whilst it was left with the control of markets, slaughter house, cemeteries and waterworks. The Sherbro Municipal Board was dissolved, and the District Commissioner was saddled with its duties. In the Sanitary Department, Mr. H. Simms was appointed Sanitary Engineer.

The reconstruction of roads to prevent hollows for the accommodation of puddles, and "to some extent" the canalization of streams, as advised by Sir R. Ross and his co-workers of the Liverpool School of Tropical Medicine Malaria Expedition in 1899, are still in process of completion. The securing of an Ordnance Survey of Freetown has been sanctioned, and must prove a valuable adjunct. An intercepting drain as advised by Professor Simpson, to aid the drainage of land sloping from the mountains, is said to fulfil its work well, and its extension is advised. "Soakaway pits" near water standpipes are stated to act efficiently in preventing pools of water. The splenic index in 1,150 boys and girls examined was 24·08. Fines for "police and larvae cases" yielded £60 2s. 6d.

Bonthe is a town that flourishes on a map drawn up for town planning in 1870, but mere outlines actually exist. The place is represented by dwellings separated by swamps, through which it is being attempted to run roads.

In administration, advance has been made by the ruling that before a house is built the ground shall be inspected and approved by the Medical Officer of Health. It is suggested that in 1913 steps will be taken to supply towns in the Protectorate with "good wells" in lieu of mere water holes now used by natives. This Section of the Report ends with the recommendation that a whole time Health Officer be appointed for Freetown.

Anti-malarial measures in Freetown.

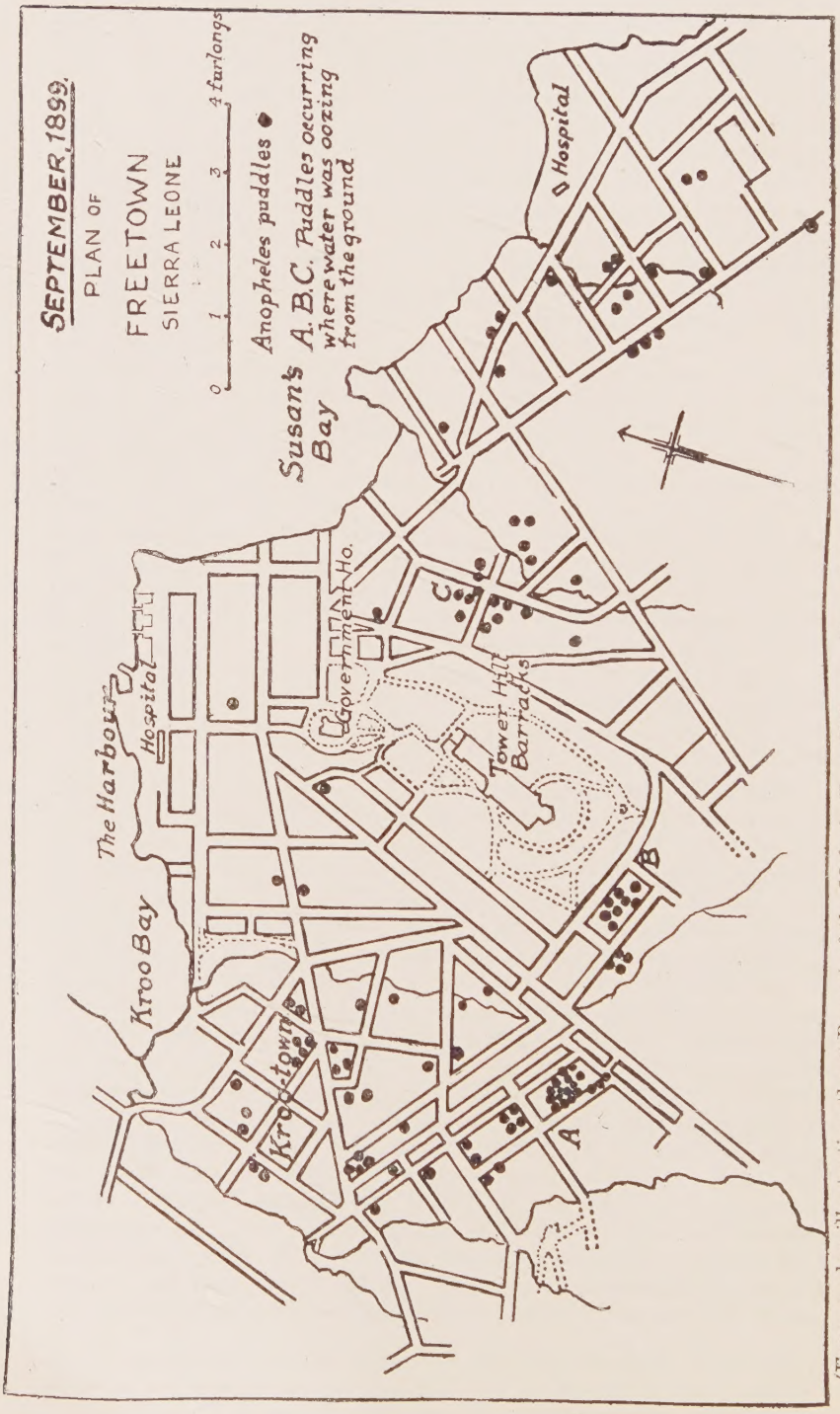
Having regard to the fact that Freetown, Sierra Leone, was the scene of the first application on a large scale of "mosquito reduction" as an anti-malarial measure, under the personal advice of Major (now Sir Ronald) Ross as far back as 1899, a report on the sanitary condition of that town in 1912 is of peculiar interest. That similar measures since instituted, on the principles then propounded by him,

plus a general advance of other sanitary efforts, have proved of vast utility in saving European life in West Africa generally, statistics amply prove.* A death rate for European officials of 75·8 per 1,000 on the Gold Coast, and 53·6 per 1,000 at Lagos between 1881–1897, now contrasts with rates which some European cities might envy, were constitution of populations and the saving grace of invaliding ignored. But, when attention is concentrated upon Freetown, although there is reason to believe much benefit has been reaped by the population, it is difficult to obtain statistical proof of such an opinion. In the neighbourhood of Freetown, if the West African Troops, who are of indigenous races and show much immunity, be excluded, and the statistical returns for European and West Indian Troops be relied on, the admission rate for malarial fevers is still excessive. The military authorites are of course responsible in these instances; but they plead that infection probably occurs when Freetown is visited by the men. As Freetown possesses medical institutions, and a municipality by which birth and death registration is conducted, it might be supposed the "tu quoque" argument ought to be easily disposed of. These municipal statistics cannot however be accepted unreservedly. Tho total death rate in 1912 is stated to have been 22·11 per 1,000, and the birth-rate 17·21. This birth-rate is ultra-modern for races as found in Freetown; it was even less in 1911, being then but 14 per 1,000. It is unlikely that the death-rate of 22 per mille is the full total, if associated with an infantile death-rate of 201 per mille of births, which the report records. However, if they are taken for what they are worth, it is found that the death-rate, instead of showing a consistent improvement, has fluctuated; so that from 1901–1907 the figures were, successively, 28·9, 24·9, 23·9, 26·9, 29·6, 23·6; in 1907, 27; in 1911, 21 per mille.

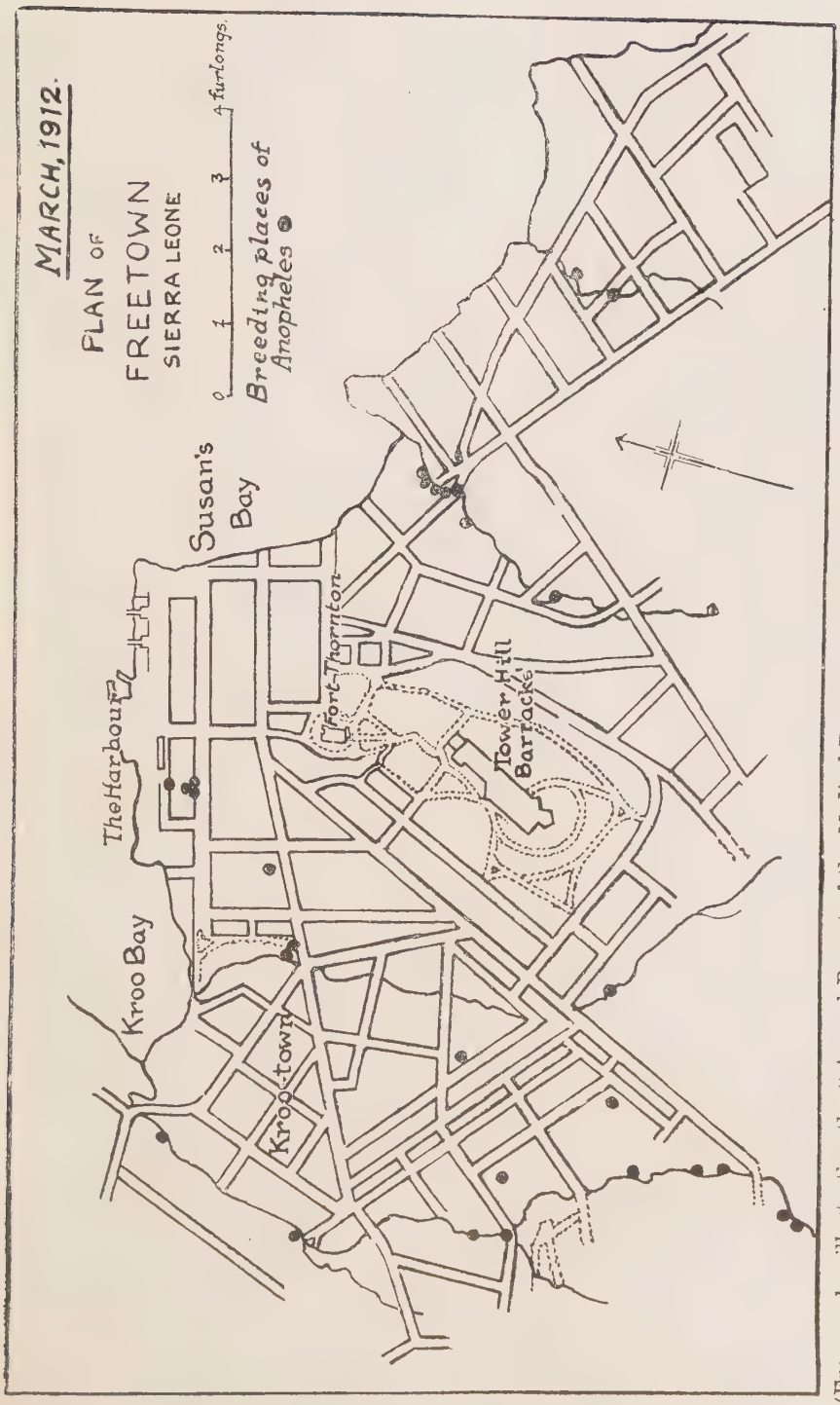
If the Medical returns be trusted to, it is capable of being shown that, between 1910–1912, malarial fevers treated in hospital declined from 1207 to 967. But medical returns may exhibit a falling off in attendance from other than permanent removal of causes of malarial fever spread. For example, it is suggested that, during the last decade, there has been a diminution of rainfall, whilst, in any case, such returns fail to distinguish between residents in the town and its surroundings. The percentage of malarial fevers for a series of years of total deaths registered, *plus* meteorological data, might have been helpful. Available figures however show that, in 1906, the percentage was 13, in 1910, 13, and in 1912, 16. The necessity for creating a trustworthy standard for future comparison was first recognized by Dr. Daniels in 1901.† He suggested the use of splenic enlargement of children of fixed ages; but it was not till 1911 that such information was required by the Colonial Office, for incorporation in the Annual Medical and Sanitary Reports. In the case of Freetown, in 1911, the splenic index found on examining 1,149 school children was 16 per cent; but, in 1912, examination of 1,150 children gave 24 per cent. In the latter year house compounds showed a variation of mosquito infection from 2·4 to 15·5

*See *Lancet*, 1912, May 18, page 1356, and 1912, Sept. 14, page 776.

†First Progress Report of the Campaign against Mosquitoes in Sierra Leone (1901). *Liverpool School of Trop. Med. Memoir* 5, Pt. 1.



(From a plan illustrating the "Report of the Malaria Expedition to Sierra Leone (1899)" by Ronald Ross, D.P.H., M.R.C.S., H. E. Annett, M.B., D.P.H., & E. E. Austen.—*Liverpool School of Trop Med Memoir 2.*)



(From a plan illustrating the "Annual Report of the Medical Department [of Sierra Leone] for year ended 31st December, 1912.")

per cent. according to month and season. No statement as to malarial parasite index appears in the Report.

Not only are available statistics unsatisfactory, but the information at disposal since 1899 leaves the impression that anti-malarial measures have not been conducted from year to year with uniform vigour.

Indeed, Dr. Logan TAYLOR* reported that "even after one year's scavenging of their town, the Freetown authorities do not seem to be the least inclined to begin and do it for themselves." The Senior Sanitary Officer, in the above Report, thus summarizes the work done in the interval: "Since then (1899), something has been done in canalization of the principal streams, and most of the roads which were criticised by the expedition have been top-dressed and do not now retain water in holes on their surface, but the drains remain in much the same condition." He gives a map showing the breeding places of anopheles in the dry season, and he suggests contrast with the spot map prepared by the First Liverpool Tropical School Expedition, which showed conditions in the *wet* season (pp. 338, 339). As might be expected, large pools are more numerous in the map of the Expedition; but the present *dry* season map exhibits the peculiarity of the anopheles pools being found at the periphery of the town to the exclusion of the central area, whilst they occur just as readily at the head of a stream bed as at the points of discharge towards the sea. This would at least suggest that, if conditions have been improved in the central part of the town so that pools are less frequent there, either too little attention has been paid to the periphery, or invasion of pools by anopheles has occurred from areas surrounding the town; that is, the condition of land beyond the immediately inhabited area has not been sufficiently attacked—a possible sequence of the fact that authority over the land is divided between the military and civil administration.

As for actual measures taken, much of the attention paid in past years within the town has been more suitable to the reduction of the culex and stegomyia than the anopheles; and it is suggested that Freetown reaped the advantage by being well prepared to resist yellow fever during the outbreak of 1910. Dr. DANIELS, in his report just referred to, calls attention to areas beyond the town possessing numerous springs, for example, near Mount Aureol, Grassfield District, Wilberforce Barracks and Kissy and, besides, refers to unprotected wells and latrine pits within private premises in the town. Evidently, also, the attention of Professor SIMPSON was arrested as to the surroundings of Freetown; as, on his advice, an intercepting drain has been made for diversion of surface and subsoil water from Brookfields, and the Senior Sanitary Officer urges its completion. A photograph of this drain, attached to the report, shows a lively subsoil discharge at scattered points; but the uphill area exhibits the surface water standing in pools close up to the margin of the drain—a matter that should be capable of remedy by grading the surface, or making surface drains discharging into the intercepting drain. This, then, is the limit of action in the environs of Freetown, if the occasional clearings of ground by the military, in the immediate vicinity of their barracks, be excluded.

*Second Progress Report of the Campaign against Mosquitoes in Sierra Leone (1902). *Liverpool School of Trop. Med. Memoir* 5, Pt. 2.

The tables attached to the report, as required by the Colonial Office, should be of utility in showing details of sanitary and anti-malarial work performed within Freetown. But their perusal shows that of 92 houses occupied by Europeans, none are mosquito proof; that the excreta of the population removed daily from the town is a poor fraction of the total; that both public and private latrines are below requirements; that faecal cess-pits abound; that of 495 wells only 11 are mosquito protected; that no new public drains were made during the year; that no excavations or low-lying lands were filled up; that only five men were employed in oiling pools and drains for mosquito reduction. The tables show that 18 inspectors are employed, or about one for every 2,000 inhabitants; yet the total compounds inspected per working day per year did not exceed 15 per head. Neither huts nor compounds present areas that would justify this slender outturn of work; and it certainly would not have added materially to the duties of these men to undertake the checking of vital statistics as a routine duty when visiting premises on anti-malarial work, and thus materially aid birth and death registration.

Irrespective of division of authority between the civil and military outside Freetown, the report shows that whilst the municipality controls markets, slaughter houses, cemeteries, water-works, public lighting, and tax-collection, the Government have assumed the duty of scavenging, sanitary inspection, building inspection and regulation—*imperium in imperio*!

We have entered into the above details in support of the Senior Sanitary Officer's recommendation for the appointment of a whole-time Medical Officer of Health for Freetown, as a step towards securing that the first British anti-malarial measure founded on Ross's discovery should no longer be allowed to have an indefinite sequel, as a result of divided counsels and spasmodic and incomplete methods.

To the Sanitary Officer's proposal, however, we would add the rider that, prior to the appointment of a health officer, a special agreement should be entered into by the Military and Civil authorities, so that not only Freetown but its surroundings should be sanitarily surveyed by an anti-malarial specialist, to whom should be attached an intelligent engineering subordinate. Thus armed, a specialist could produce a complete scheme and estimate. A Medical Officer of Health could follow for maintenance on completion of the works.

An obvious objection to such a scheme must be "lack of funds." But the "saving [!] from the authorized expenditure of the Sanitary Department" of £2,279, allows room for belief that with the impetus afforded by the presence of a special officer such failure of use of funds need not occur in future—even if re-allotment owing to unexpected incidents were necessary—and that the raising of a loan for permanent sanitary improvements should be feasible. Locally, it is possibly appreciated that the recent placing in the market of a loan for a million pounds by Sierra Leone, of which 93 per cent. lapsed to the underwriters, might have gone off more brilliantly had the Colony a better fame for health. Again, the military authorities might see in the probable decrease of the present invaliding rates a ground for a solid contribution, whilst a healthy port should appeal to the civil administration as a desirable asset. The total exports in 1889—the period of the first Liverpool Expedition—were valued at £366,000; by 1910,

the value was £1,249,367—an increase that might reasonably be connected with a considerable grade of improvement of the health conditions of the Colony, which should encourage to further and more radical sanitary measures. The actual expenditure for sanitary purposes of the revenue of the Colony in 1910 did not amount to one per cent. of the total; notwithstanding other urgent demands upon the funds of the Administration, a greater contribution than this would seem reasonable.

Uganda.

*(1) *Medical Section.*—The population of the Protectorate, according to the census of 1911, amounts to 2,840,468. Calculated, necessarily, on figures resulting from incomplete registration, the death-rate was 21·5 and the birth-rate 24·2 per mille. Of the total admissions amongst Europeans for medical treatment, 36 per cent. suffered from malarial fevers, 1·04 from blackwater fever, and 17 per cent. from diseases of the digestive system. Amongst natives there were 932 deaths from sleeping sickness (against 1,487 of the previous year), 519 from small-pox, and 289 from measles. According to native Returns there occurred 3,100 deaths from plague, the area chiefly infected being Bukedi. Undulant fever, relapsing fever, and venereal diseases are important causes of morbidity amongst natives.

(2) *Sanitary Section.*—The Medical Sanitary Officer assumed office in July 1912 and, before proceeding to offer advice, very rightly devoted much time to gathering various data and existing rulings affecting sanitary administration. During the year, local sanitary committees were appointed for six townships, and for the first time the local Medical Officers concerned had a share in the general sanitation of their respective townships. These committees are composed of the medical officer and district engineer as members, with the district commissioner as President; the latter officer retains executive authority. Subsequent to the constitution of these committees they were given the power to condemn Government buildings, subject to the concurrence of the Medical Sanitary Officer. At one of the townships (Jinja), independent of the local sanitary committee, a number of traders, of their own option, formed a Committee which undertook night-soil and rubbish conservancy, *at their own expense.* In Mission Schools and amongst police units elementary hygiene is taught.

Under Ordinances ordinarily applicable, a further area in the Western Province was proclaimed infected with sleeping sickness. Kisumu, in British East Africa, and Naruboyu, on Lake Chioga, were declared infected with plague; enteric and cerebro-spinal fevers were included as infectious diseases, and syphilis was declared "a dangerous disease." Draft laws regarding the latter disease are to be placed before the Colonial Secretary for sanction.

Under the licensing of trades subject to a Medical certificate, manufactories of soda-water were included. By a Committee representative of Law, the Civil Administration, the Sanitary Department and the Department of Public Works, draft rules were formed dealing with the whole range of administration in urban sanitation, including anti-malarial measures. In consultation with the Department of Public Works, official dwellings have been improved as to ventilation and orientation. In the sphere of town planning, rulings were obtained as to "sanitary lanes" (scavenger lanes) behind plots and as to "open spaces." The question of keeping the European residential quarters apart from those of Asiatics and Natives was borne in mind.

Against malaria the usual minor measures were effected "in the principal stations" by gangs of from six to twelve men in each. In the

*Uganda Protectorate. Annual Medical and Sanitary Report for the Year 1912. [Principal Medical Officer, A. D. P. Hodges; Medical Sanitary Officer, C. J. Baker].—76 pp. f'cap. 1913. Printed by Waterlow and Sons, Ltd., London Wall.

dwellings of officials wire netting was employed, and in the barrack of the Indian contingent both wire netting and bed nets were used. Under major measures, the already accomplished draining of swamps at Masindi, Hoima and M'Bale was maintained with good results. At Kampala the draining of the Nakivubo swamp, which is regarded as a necessary work, has been treated spasmodically, owing to "lack of funds."

Against sleeping sickness extensive clearing of fly-infested jungle and removal of 14,000 people has been effected, so that, with the exception of a portion of the White Nile, all the principal trade routes may be said to be now "free of infection." The Medical Sanitary Officer, however, holds that the disease is not stamped out. He states, "It would be unwise to relax any of these measures without the fullest consideration." The necessity for one trained Sanitary Inspector, at Kampala at least, is urged.

Haffkine's anti-plague vaccine inoculation was used in 13,458 cases. The danger of receiving from the infected area unginned and unpressed cotton, lest it contain plague infected rats, is represented. The use of rat-proof isolation huts is suggested at ports in the endemic area.

In regard to small-pox, the establishment of a "vaccine farm" is advised. The locally supplied lymph does not give satisfactory results at present.

The bucket removal system is gradually replacing the native "choo" —a cess-pool method. Destruction of excreta in small incinerators is practised *where fuel is cheap*; trenching is adopted elsewhere. But at Jinja the Medical Sanitary Officer advises that "all the night soil, except that collected at a considerable distance, be thrown into the Nile."

Malaria.

The Medical and Sanitary Officers responsible for this Report are fully alive to the necessity of affording the advantages of curative and preventive medicine to the population of the Protectorate. If development of trade and trade routes is hoped for, malaria, sleeping sickness, plague, and small-pox must be either got rid of, or rendered impotent to check commercial progress. Hence it is to be regretted that the difficulty in gathering statistics, which must be encountered in all countries recently opened up, impedes the possibilities of fully gauging the rate of advance. Thus, in the presence of anti-malarial measures, the only guide afforded is hospital statistics. These may be broadly true, but are open to the criticism that the extent of relief sought for is influenced by the local popularity of the consultant, or native belief in particular remedies. Had the stations where measures have been undertaken been inspected with regard to the malaria endemic index, or even splenic index, some criterion would have been afforded.

The report as to major sanitary works against malaria shows either a lack of appreciation of their commercial value by the local civil administration, or a lamentable lack of funds. Thus, whilst the good results of drainage of swamps at places mentioned above are officially recognized, and the systems are consequently maintained as permanent works, a halting policy has been adopted in respect to those at Nakivubo. Since 1910, at intervals, a total of £664 has been expended, with excellent results so far as the drying of adjacent land is concerned; but a portion of the swamp owned by Government would require a further £1,500 to reclaim it, and this is not forthcoming. It is apparently an instance of looking back after the hand has been put to the plough. It was within the power of someone in authority to ascertain what the reclamation would cost, and either have sanctioned it as a whole work, or have prevented an expenditure of nearly £700 on a portion and, therefore, on a comparatively futile effort

If it be held the first efforts were experimental, the feasibility of the work having been duly demonstrated, it should now be followed by further advance. In cleared ground, as a petty anti-malarial measure against affording shelter for mosquitoes, much faith is put in the planting of "French Grass" (*Cynodon dactylon*). It is reported to grow even on sandy soil.

Plague.

In the matter of plague, beyond the fact that inoculation has been favourably received by the natives, and that cases and contacts are segregated "when reported," it cannot be said that any definite information as to staff engaged, or of action taken, is forthcoming. The building of rat-proof huts in certain ports and the suggested danger of unginned cotton are subjects not yet administratively dealt with. The important question as to what radical action is feasible within the plague endemic area has not yet been apparently considered; and this the Medical Sanitary Officer points to as follows:—"The Regulations provided for plague prevention should not be relaxed, and should be exploited in the endemic areas hitherto untouched." Obviously, attacking the fire at its centre—not merely guarding its periphery—is what is required with the utmost promptitude. Side by side with the opening up of trade routes, and the increase of passengers and goods traffic, plague must shortly become of increasing sanitary importance; hence early and definite action would seem to be called for. The apparently small and scattered nature of the villages and the definite lines of trade routes have hitherto been favourable to slow spread. As Professor W. J. SIMPSON has recently been deputed to special duty in East Africa, his long experience will doubtless be fruitful of a complete scheme.

Sleeping Sickness.

The following extract from the Report by the officer in charge of sleeping sickness administrative measures (Mr. E. HADDON) gives a distinctly hopeful view of progress: "Our efforts have already made an enormous difference, and fly, when found, were never numerous in places where formerly they swarmed. Many of the clearings are partially being kept up by the natives, and low-growing food-stuffs planted on the rich soil." The prospect not only of the clearings being utilized for cultivation, but, in the Nile area, of extirpating the fly by action within selected spots should appeal to the economist as well as to the sanitarian.

On the other hand, in a paper by Dr. H. Lyndhurst DUKE,* after referring to the work of KINGHORN and YORKE, as showing that in Nyasaland the trypanosomes in local game are identical with the *T. rhodesiense* of man, he adduces reasons for holding that in a part of the Uganda Protectorate on the Victoria Lake, the trypanosome of game is indistinguishable from the *T. gambiense*. He, therefore, advocates game destruction as an essential for human increase, and states: "Given a number of fly and antelope in a district, there is nothing to prevent the infection with *T. gambiense* being kept up indefinitely." Possibly there is a way out of the difficulty, which the

*DUKE (H. L.). Wild Game as a Reservoir for Human Trypanosomes. An Analysis of the Available Evidence from the Northern Shores of Lake Victoria Nyanza.—*British Med. Jl.*, 1914, Feb 7, pp. 289–292.

term "indefinitely" used by Dr. DUKE naturally conjures up. It may be that to hold the country by cultivation of clearings, within a defined limit of which game could be kept severely under, whilst within the clearings and their immediate neighbourhood preventive action as to fly, man and beast could be taken, would prove a better fight than the present depopulation arrangement.

Conservancy.

Both the Principal Medical Officer and the Medical Sanitary Officer contend that the casting of the night soil of the town of Jinja into the Nile, as a routine method of disposal, is justifiable. The reasons relied upon are that, for thirty miles below this site, habitations have been removed, in connection with sleeping sickness measures, and that rapids exist. It is not suggested that below this there are not populations; whilst it is known that the visiting of the cleared area by the natives occurs—though forbidden. As the decision is deliberate, it has doubtless been arrived at after a careful consideration of physical and bacteriological data applicable locally. Dumping *en masse* daily night soil and urine of a population of 3,000 in a river is not quite analogous to such disposal of sewage after it has undergone bacterial change incident to slow progress through sewers. Presumably, however, destruction of the *B. typhosus* is not rapid locally, as the Report records "of the cases [typhoid] at Jinja, 7 were attributed to drinking contaminated water obtained from the vicinity of the pier of Jinja." In view of this statement, it would have been of utility to have described the position of the dumping spot (above or below the town) in relation to access to the river by the native residents within the township. But, putting such points aside as doubtless taken cognizance of locally, and granting that the procedure bacterially is safe, the ideal of night-soil disposal by dumping in a river is not one which should lightly be placed before a native community young in sanitary experience; especially one, as in this instance, so enlightened as to volunteer to pay for town conservancy.

Preserved Vaccine.

The total number of vaccinations, viz., 41,621 in a population of 2,840,000, is small, but the fact that anti-plague inoculation is accepted and even asked for would show that, under favourable conditions of sufficient and efficient staff supplied with animal vaccine from a central "farm," as advised by the Medical Sanitary Officer, rapid advance could be made. Meanwhile, experiments with varieties of preserved vaccine are in progress, viz., dried lymph, lanolinated lymph (both supplied by the Lister Institute), and Nairobi lymph (presumably glycerinized). No information is given as to date of manufacture, means of storage, or transport under tropical conditions. The order of success is reported to have been in the sequence just stated, but comparison of the figures at pages 12 and 24 of the Report shows that the mistake has been made of calculating the success rate whilst including the "unknown" in the total. If this be attended to, the lanolinated lymph is shown to have given the best results, not only as to success rate but as to absence of entries under column "modified results"; whilst the "dried lymph" takes the second place. This experience is in accord with the results, as to duration of activity of

vaccines, of recent experiments in their tropical colonies by the Germans, as recorded by VOIGT.*

Sanitary Administration.

A statement of financial circumstances of the Medical and Sanitary Departments, respectively, is supplied. The data given at page 6 of the Report refer to "estimated expenditure" for 1912–13; but, as this period is reported upon for the calendar year (1912), it is an open question how far money allotted under anti-malarial measures and sleeping sickness has been expended before the last quarter of the financial year, or has been allowed to lapse.

No better summary of the sanitary circumstances dealt with in this Protectorate can be made than in the following statement by the Principal Medical Officer:—

"If, however, sanitation is to be improved to meet the conditions brought about by the rapid increase in the buildings and in population, funds must be available to carry out or extend such schemes as are found necessary, concurrently with the development of townships, especially for conservancy, drainage, water-supply, hospital and prison accommodation; and staff must be available for effective sanitary supervision."

To the demand for money and a suitable trained staff may be added the plea that it is essential on the grounds of public health and financial economy that public bodies should, by timely legislation, and purchase where necessary, acquire control of land and water rights before private invested interests be asserted. It is therefore of poor augury that the large loan recently sanctioned by the Colonial Office for Uganda is stated to be solely on behalf of improvement of "communications"; no mention is made of public health necessities.

CEYLON

†The Report under review embodies results obtained on recent inspection by Major JAMES, I.M.S., assisted by Dr. W. T. DE SILVA. The details furnished show that a careful inquiry into local conditions has been conducted, which must have necessitated great care and physical strain. That we do not concur with all his conclusions by no means alters our appreciation of the value of the data which Major James has laboriously collected, and on which his conclusions were founded.

Rural areas.

He opens his report as to Jaffna by reference to conservative Hinduism and the customs and prejudices of caste, in respect to their supposed inhibiting effect upon sanitary progress, but very rightly concludes, "highly important as they are undoubtedly, it is easy to make too much of them and to regard their recital as sufficient justification for lack of action with regard to sanitary needs."

*VOIGT (L.). Die Versorgung tropischer Schutzgebiete mit Kuhpockenimpfstoff. Erfahrung und Versuche.—*Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* 1911 Dec. Beiheft 10. pp. 497-521.

†JAMES (S. P.), M.D., D.P.H., assisted by W. T. De SILVA, I.M.S. Reports of Sanitary Inquiries in Jaffna and the Northern Ports and in Galle.—8 pp. f'cap. With map. 1914. Colombo: Printed by H. C. Cottle, Government Printer. [Ceylon Sessional Papers. IV. 1914. Price 25 cents.]

The physical characteristics of the area around Jaffna are such as to justify his separate consideration of a portion known as the Kalmanai spit, as contrasted with villages in closer proximity to Jaffna Both areas are but slightly elevated above the sea level, and possess a high level of subsoil water, which appears as springs on the margins of the sea-shore, in limestone rock with large crevices and, at times, "forming huge underground caverns containing a large storage of rain water" and yet, at intervals, many wells containing water, hard and brackish. But, in Kalmanai, the high level of subsoil water makes itself apparent by numerous fresh water springs, whilst there are also hillocks of sand "or sand dunes," where it is "scarcely necessary to do more than scoop away a few handfuls of sand in order to obtain fresh water." It follows that the villagers use largely wells for drinking water which are mere shallow excavations of sand. Irrigation of rice crops and fruit-bearing trees is largely conducted.

Under conditions such as are described, it is not to be wondered at, given the human malaria bearer and the mosquito proper to that end, that malaria should have become endemic, and that the addition of rainfall readily exaggerates the physical conditions tending to favourable pool formation. On the Kalmanai spit the splenic index was 70 per cent.; whereas, in the villages nearer Jaffna, this varied from *nil* to 3·3 per cent.; showing that in the latter villages malaria was in abeyance during the period of his inspection, namely, the dry season. In the case of the Kalmanai spit it was, however, noted that "the spleens of quite a large number of children and young adults were enlarged greatly beyond the umbilicus, the enlargement being accompanied by a serious condition of anaemia and debility, which was in marked contrast to the apparent healthiness of the children (including those whose spleens were found to be enlarged) in the neighbourhood of Jaffna." To ascertain the cause of this aggravated condition, Major James conducted a special enquiry. He considered that neither the physical conditions of Kalmanai, as affording facilities for mosquito propagation, nor the species of anopheles found (the *culicifacies* being largely distributed, and, in his opinion, being the chief local bearer) presented any difference in the two areas that would account for the extreme condition of the inhabitants of Kalmanai. He concludes they suffer from "residual infection" in systems lowered by "their mode of life," so that they remain infected throughout the non-malarial season. Elsewhere, it is stated that the people are "very poor, very primitive, very ignorant and (as a result of ill-health) very apathetic." It is disappointing to find that the only remedy that he found himself in a position to advise is that with which he has identified himself in India, namely, the confining of anti-malarial operations in rural areas to the distribution of quinine. In this case he recommends that this be chiefly accomplished by "travelling dispensaries."

Unfortunately the report gives no indication as to how the mode of life of this people differs from that of villagers nearer Jaffna, and the reader is left in doubt as to whether their poverty is not more due to lack of ability to labour than to the absence of available work; of which there must be a reasonable amount in the rich tract round Jaffna.

As already stated, Major James made his inspection during the dry season; and it seems to us, therefore, that he was hardly in a fair

position to correctly gauge the conditions of contrast of the two areas. Obviously, in both, the subsoil water level is such that the monsoon addition of rainfall readily saturates a soil already under the influence of capillary attraction, so that pool formation is an easy matter; but, whilst this is common to both, in Kalmanai the chances are that this influence would be much more pronounced, having regard to the additional factor of the water laden sand dunes, evident even during the dry season, and the frequency of excavations by scooping for water for drinking purposes in the sand. Under such circumstances, in the dry season, excavations are usually made only at spots where water is known to persist through a long period, but with a heightened subsoil water level during the rains such artificial pools are likely to be more numerous, because they are more readily obtainable within distances convenient to individuals. In short, we suggest that in Kalmanai, having regard to its physical characteristics, as described by Major James, the rainfall of the wet season would have a quicker and throughout the following dry season more lasting influence in the production of oozings of springs and persistence of pools than in the villages near Jaffna. Whether this theory be right or wrong, it seems undesirable that the villagers should be condemned to no effort beyond quinine prophylaxis, on evidence gathered solely during the dry season. The case would seem one where further study should be made in the two areas both in the wet and dry seasons, so as to determine the relation of splenic indices, subsoil water levels and rainfall. In his inspection, doubtless, Major James had not time to enquire into these and other factors, such as the prevalence of ankylostomiasis or kala azar—neither unlikely contingencies, as the people were largely Tamils. Whilst quinine prophylaxis would fill a useful sphere, it would have been more satisfactory, before he advised trusting solely to this remedy, to have made it clear why in this locality mosquito reduction by oiling, and the use of means to relieve, in some useful measure, surface and subsoil water, were impossible. At least covered shallow wells, or tube wells, might have replaced with advantage the shallow drinking water pits, which are ordinarily excellent mosquito breeding places.

Urban Areas.

In treating the town of Jaffna, the report deals more intimately with applied hygiene when, as an anti-malarial measure in certain cases, the complete working out of a surface drainage scheme and due attention to the capacity of road culverts are advised. In discussing a public water supply which the author urges as necessary, he shows that two schemes had some time back been drawn up, but neither could be executed for want of funds. He then suggests that the mode of assessment for purposes of taxation is inefficient, and brings forth ample proof that the people of Jaffna could well afford better contributions to public funds, and that means therefore should be taken to add to the finances of this Local Board. We suggest, however, that the quickest way out of the difficulty is to raise Jaffna to the rank of a municipality. Indeed, if the Government of Ceylon have not some strong and exceptional reason for maintaining a town with a population of 40,000 under rulings applicable to rural areas, it would seem an instance of mischance in official foresight that this was not long ago carried out.

As showing that, under the Act applicable in Ceylon, a municipality of approximately the same population, in a reasonable state of prosperity, should be able to pay for a water supply scheme, the town of Galle, which was next inspected by Major James, may be quoted. Here public waterworks were introduced in 1911. If it is not a sample of instances where there occurs an absence of that full threshing out of details of water schemes which we have advocated under our Note "To meet changing views," the condition of the water supplied is suggestive of invasion by odour producing organisms; for it is found that, at present, its smell and colour render it impossible even for bathing purposes, so that the inhabitants are using well water for which they pay by the potful.

Major James shows that in Galle and in Jaffna, in the matter of night soil and rubbish conservancy, both plant and staff are absolutely inadequate; and he urges the replacement of untrained sanitary inspectors, as now employed, by a staff of technically trained men, supervised by qualified medical officers of health.

Anti-Stegomyia Campaign.

The object with which Major James was deputed to Ceylon by the Government of India was understood to be chiefly to undertake a survey of *Stegomyia* prevalence, in reference to possible introduction of yellow fever. He however concludes his report by declining to recommend the expenditure of money upon an anti-stegomyia campaign, in towns possessed of so low a grade of sanitation as Jaffna and Galle. He apparently does not believe, for example, that the people of these towns can be protected from insect-borne diseases solely by subjecting them to elementary education. Instead of attempting, before applying public sanitary methods, to attain a standard of personal and domestic hygiene for rural areas as advocated by the Imperial Government of India, he conceives it necessary, in the first place, "to raise the general standard of sanitation in the town by making progress with the primary sanitary needs in connection with water supply, conservancy, drainage, and the organization of a trained sanitary staff provided with the necessary facilities and appliances for efficiently carrying out their highly important duties. By those means alone will the way be sufficiently prepared for the adoption of such specialized forms of sanitary effort as the reduction of mosquitoes."

British Guiana.

*This Colony has an area of 90,520 square miles and (excluding aborigines) a population of only 296,000. Its prosperity is at present chiefly dependent upon sugar cultivation, which is conducted in a mere strip of 70,000 acres of coast territory, whilst inland commercially highly valuable woods, and large areas suitable for cattle rearing remain unexploited. To develop these enormous resources, communications by rail and river navigation must be at the disposal of the capitalist. The problem he has to consider is that familiar in most newly opened tropical areas, of how best, in the presence of special diseases, to conserve labour, when handicapped by the

*British Guiana.—Report of the Surgeon-General for the year 1912-1913. [Acting Surgeon-General, E. D. Rowland.]—112 pp. f'cap. 1913: Georgetown, Demerara: The "Argosy" Company, Ltd.

necessity of trusting to importation; the aborigines of the area in this case being unsuitable. The conditions must be that (*a*) reasonable health can be calculated upon by the immigrant, (*b*) that the importer be not taxed with unnecessary cost of voyages and contracts due to the supervening of preventable sickness and death, and that (*c*) local conditions be such as to induce the permanent settlement of families of labourers. So far reliance has been placed upon coolies obtained from India.

The Surgeon-General's report shows that indentured immigrants - presumably of labour-fit physique and age—died in 1910–11 at the rate of 18·2 per mille; but, during the following years, this fell to 17·3 and 13·3 respectively. The last rate, whilst doubtless due to increased care in anti-malarial and general sanitary measures, must have been largely aided by the favourable influence of recent drought. These rates are found in a population of 66,000 on sugar estates, and under the increasingly favourable conditions of care exercised by owners. The prevalent diseases amongst this population are malarial fevers, ankylostomiasis and tuberculosis—all diseases which sap working powers, but are nevertheless capable of being defeated by sanitary measures. Such death rates, however, do not compare badly with those of the British Army in India within this generation. But when the population is removed from the sanitary environment of estates and settlement is attempted in villages, the evil influence of these diseases is accentuated; the rates in a mixed population of various ages are swollen by an infantile mortality of 225 per mille of births. (five years average) a total death rate of 30·2, and a birth-rate of 31·2. The small increase of the total population, to the extent of 18,000 in the intercensal period 1891 and 1911, is accounted for not by natural increase but by indentured immigrants. Obviously, therefore, if expense of importing labour is to be avoided, the death-rate of these villages must be decreased.

In thus regarding this matter, the humanitarian view is much discounted by the fact that, heavy as the death-rate is in villages, it compares favourably with that of the country the East Indian labourers have left—the five years average for the Indian Empire up to 1912 being 34·85.

The Surgeon-General makes a special point, in pleading for sanitary reform, that typhoid fever is steadily making its way from Georgetown, where it has prevailed for some years, towards the villages, and that decided and early action is necessary if its spread over the country generally is to be prevented. He thus describes conditions in this important centre:—"Were it not for matter of sanitation effected by the breeze and sun, Georgetown would be as hideous as some of the cities of the Middle Ages when affected with plague."

In opening up the country by railways, and improvement of harbour accommodation, the importation of labour must be greatly increased. The immigrants must enter by the coast line of the country, where they will mingle with labourers already available, and with them make their way towards the interior. The result will be that the diseases which are now making attacks upon the sugar estates will assume their sway in camps and hastily built villages in the interior, under less readily dealt with circumstances than the present.

It seems, therefore, a reasonable method of approaching the problem of opening up this so-called "neglected colony," as a first step, to place its existing towns and villages in a sound sanitary condition. Sugar estates owners have, in most cases, already realized the necessity for war against the great labour disability diseases—malaria and ankylostomiasis—and the Surgeon-General's report shows that their effort have been largely successful. But, irrespective of finance, private efforts must have their limits. There must arrive a stage when these must be supplemented by public measures, if full success is to be reaped.

Here the question must arise as to whether it would pay this colony to undertake sanitary measures whole-heartedly by raising a loan. The present public indebtedness of British Guiana is small, and it has been able systematically to pay its debt by annual instalments. In the meantime, its Customs revenue shows yearly increases. A healthy coast-line would relieve the sugar estates (the present best support of the colony) of a heavy handicap in wasteful payment for labour, and leave the capitalist untrammelled to develop the excellent natural resources inland which undoubtedly exist. In such an endeavour the British Government would be well advised in aiding the colony by a special grant. There is reason to believe that in anti-malarial measures in this area, river training for commercial purposes, agriculture and drainage may be largely co-related; so that schemes in which private and public enterprise could co-operate with mutual advantage would be peculiarly applicable.

There is at present a tendency in the Colony to economise medical staff, which should be deprecated. With a population of 66,000 immigrants on the sugar estates, over 35,000 of whom were treated in the hospitals in 1913, the office of Medical Inspector has been abolished, and his duties are now required of the Surgeon-General, in addition to his existing work. No whole-time sanitary officer for the Province has yet been appointed, whilst in contrast with this serious blank in the staff there exist posts for *two* bacteriologists. These specialists, however, instead of being allowed to pursue their science uninterrupted, have had tacked on to them the duties of Health Officer of the port of Georgetown, and Government Medical Officer to the Local Government Board. Further, the Surgeon-General reports, "to enable medical officers to obtain leave of absence, private practitioners were temporarily employed during the year without any extra cost to the Colony." Would it not be more appropriate to maintain a sufficient reserve of officers to cover such calculable vacancies?

The Colonial Office Anti-Malarial Information Forms.

The Secretary of State for the Colonies, in December 1910, sanctioned the introduction of certain forms for incorporation with the Colonial Medical and Sanitary Reports. They were based on the recommendation of the Advisory Committee of the Tropical Diseases Research Fund, as suggested by Sir Ronald Ross. They are of an excellent practical character, and should serve the purpose of exhibiting lapses in local action. As adopted by certain of the reporting officers, however, they cover much stationery and demand much hunting for facts

by the inquisitive, as each area dealt with repeats the text of the items to be reported upon. It should be possible for Administrative Officers when compiling Reports for the Local Governments concerned to concentrate this diffuse matter in their offices, so as to appear in one or more easily consulted tabular forms. "Nil" statements would certainly not be missed.

DISEASE PREVENTION.

Malaria.

The Periphery of a Malaria Stricken Town.

It must be remembered that the spot maps in the case of Freetown, discussed in a preceding Note, illustrate conditions different not only as to period and grade of effort, but between those of the dry and wet seasons; and that we have argued therefrom that, granting that measures are being taken within Freetown of a spasmodic nature, invasion from the neglected surroundings is a probable factor in persistence of anopheles at the town periphery. Hence, it is a curious coincidence that at the All-India Sanitary Conference at Lucknow, in January, Dr. Bentley "drew attention to the fact that the centre of even malarious towns was usually comparatively free of malaria." As reported by the (Calcutta) *Statesman*, he argued therefrom that "by taking steps to concentrate the scattered population of villages and hamlets, it might be possible to bring about a reduction of malaria as well as simplify other sanitary improvements." In the discussion which ensued, Captain Gill said it did not always follow that the centre of a town was more congested than its peripheral portion; in certain areas congestion during the day might disappear at night; in Amritsar the centre of the town contained generally well-to-do people, and this was a factor in reducing malaria. Major Christophers thought that the existence of lofty buildings in the centre of Amritsar was another factor in modifying the intensity of malaria. Major Perry quoted an instance of a small town in which the spleen rate was taken in 1896. Since then the population has been halved, owing chiefly to the ravages of plague. This diminution of the population had however no appreciable diminution on the spleen rate. Captain Stiles Webb referred to Palwal, where mosquitoes were much more plentiful in the periphery of the town than in the centre. Recently there had been a rapid fall in the spleen and parasite rate of that town, and he believes that this result could be paralleled in many other places in the Punjab.

It would be hopeless to generalize on such a subject; and, certainly, it would require much more evidence than given in these references to justify a policy of malaria prevention by concentration of populations, as advised by Dr. Bentley. For example, whilst clean wells may often be just as good an inducement for mosquito propagation at the centre of a town as at the periphery, the chances of securing puddles free of sewage contamination would be less the thicker the population; and whilst it is quite possible tall buildings in the centre of the town and successive lines of buildings generally may be a factor in staying invasion, the spot map of Freetown, illustrating conditions as found by Sir Ronald Ross in the wet season, shows that then the central areas had no immunity from anophelines.

Cholera.

Organization against Cholera in the Madras Presidency.

In the Madras Presidency, all the Local Bodies—Municipalities more especially—have long enjoyed self-government of a very liberal type. Consequently, when a specific sanitary scheme is placed before them with the approval of the Government, their consent to its adoption

individually, or their desire for modifications, is duly considered. Since 1895 the Madras Government has secured adhesion from time to time of the principal, and latterly of the smaller, municipalities to Rules for prevention of cholera, which have the advantage of the force of law by being framed under the District Municipalities Act, which these Bodies administer. In the last quarter of 1913 (Madras Government Order No. 1,969M of 13th October) the Municipalities of Berhampore, Chicacole and Parlakemedi in the Ganjam District have formally accepted the Rules. As the organization required by these Rules has stood the test of experience during 17 years, and has been accepted by the self-governing Bodies with caution (dictated not by objections to the sanitary measures but to the necessary financial clauses supporting them), some account of it may be useful.

The first two Rules define the nature of cholera and its mode of spread; the third states "it is the object of these Rules to ensure (1) that all the earliest possible information of every attack of cholera should be conveyed to the authorities, so that the cholera microbes may be at once prevented from being conveyed into situations in which they might spread the infection; (2) that the microbes should be at once completely destroyed; (3) that Medical assistance might be provided for those who, in spite of precaution, might be attacked by the disease. They accordingly follow these three divisions." These are stated to be (1) Observation; (2) Prevention of infection; (3) Medical aid.

Rule 4 renders Municipal Councils responsible for the general carrying out of the scheme, but the District Medical and Sanitary Officers (chief Civil Surgeons of Districts) are responsible for professional arrangements, both within Municipal limits and external to them. Each Municipality is divided into areas called "Circles," which are not to include, respectively, less than 1,200 or more than 1,500 houses, or 7,500 inhabitants. Three such circles form a Division. It is directed that the Head-Quarters of the Divisions shall be selected and marked on the map of the town concerned. The map thus divided is required to be approved by the chief civil officer of the district, and is then recorded in the municipal office, whilst a copy is supplied to the local senior medical officer of the municipality. For use within each division, a definite amount of disinfectants (whose nature is stated) and apparatus are required to be "always maintained" and "kept in good condition" by the Municipal Chairman. The following very useful financial provision is worthy of being quoted verbatim; as in its absence, on an epidemic occurring, a Municipal authority must resort to the cutting down of some other sanctioned items in their Budget—the chances being certainly that some permanent sanitary improvement would be deferred:—

"In order to make provision for meeting the charges under the portions of this scheme relating to observation and prevention, the Council of every municipality to which the scheme applies shall be required to allot in every budget, under "cholera charges," a sum which shall be in the proportion of Rs. 1,000 to every 25,000 inhabitants in the Municipality. This shall be called the "cholera reserve," and shall not be spent upon any object but the carrying of this scheme into execution.

The position of this Reserve should be not allowed to disturb the existing percentages to the total municipal income of the expenditure

upon the communications, education, sanitation, etc., or to swell the totals of the allotment made for sanitary purposes, under grants 1, 2, 3, and 4, taken together, but should be set aside from funds which are at present annually expended upon sanitary works of a permanent nature."

The organization and duties required of the staff differ according as the period is one of "observation" or "prevention." Under the first head, the prime object is that the Chairman shall be notified of the approach of cholera. That it may be understood how this warning as to cholera "imminently threatening" a municipality is obtained, it is necessary to state that in the Madras Presidency, although sanitary staff organization in rural areas is certainly, as in the case of municipalities, far in advance of other parts of India, in the majority of Districts it is still necessary to rely largely upon officials of the Civil Administration for the gaining of intelligence of first cases of epidemic diseases, outside the limits of municipalities.

The Chairman may receive warning from the chief Officer of the District, or from any other subordinate Revenue or village officer. Warning also may be sent to him by the Sanitary Commissioner or his Deputy, or by a District Medical and Sanitary Officer. In these cases, by a Government executive Order, a Chairman is bound to call a meeting of the Council within three days if the official letter be marked "epidemic urgent"—whether the epidemic be cholera or other disease. The Chairman is therefore not liable to err from lack of a "Remembrancer." The civil officials secure prompt information by a ruling which is rigorously enforced by them that each Village Head must report cholera, small-pox, or "other unusual disease" *by the most expeditious method* to his immediate superior officer, and to the Heads of the neighbouring villages. Any instance of neglect of this useful order is always promptly represented by the officers of the Sanitary Department. This method of warning is strengthened by requiring the District Medical and Sanitary Officers of the adjoining districts to communicate with each other daily the movements of cholera—telegrams being used when necessary. The immediate superior officer of a Village Head (Tahsildar), receiving information as to cholera in areas devoid of a sanitary staff, informs the nearest Sub-Assistant Surgeon in medical charge of a dispensary, which institutions are usually at distances from each other not exceeding ten miles. As an urgent matter, this man closes his dispensary (out-patient institution) and at once proceeds to the village concerned, takes the first preventive measures, offers treatment, and *awaits relief* by the District Medical and Sanitary Officer sending special sanitary and medical subordinates.

Having by one or other of the agencies mentioned received warning, the Chairman's duty is at once to mobilize the "observation staff." In every circle, as above defined, to the existing normal sanitary inspecting staff he is required to add a Sanitary Inspector aided by a peon (orderly) and a special scavenger. For every three circles, a special Sanitary Inspector is appointed as Divisional Inspector, and is provided with a better class orderly. Both are mounted or use bicycles. The Divisional Inspector patrols his circles searching for information, seeing that his inspectors do not shirk work, watching graveyards, and water-supplies, etc. He is responsible that

intelligence from his division is rapidly conveyed to his superior sanitary officer in charge of the whole operations of the town, and that orders received from that officer are quickly communicated to his subordinates. Doubtless in the present day telephoning will largely supplement the work of these mounted orderlies. The following duties are required of the observation staff :—

"It will be the duty of the members of the observation staff to constantly and systematically patrol the whole of their circles, in order to gain intelligence of the first case of cholera or of the first case of diarrhoea in it, so that immediate action may be taken. At such times cases of severe diarrhoea should be regarded as equally dangerous as cholera. The members of the observation staff should also be employed in removing, with the aid of the ordinary conservancy establishment, all defects in sanitation which would favour the multiplication of the cholera microbe. . . . and should report their action to the Chairman." [Under the influence of this staff, a general effort at cleansing of houses and premises follows, which may, in the presence of pronounced apathy by the inhabitants, be aided by an urgent Magisterial Order.]

. . . . "They should further warn the inhabitants of the circle to adopt precautions against cholera described in the extract from Surgeon Lieut.-Col. ———— "Simple Sanitary Rules," which is printed as an Appendix in these Rules, and should distribute copies of this, which the Chairman will keep ready printed in the vernacular, gratis and as widely as possible."

Period of Prevention.—On receipt of information of a first attack of cholera in the town, the Chairman is directed to "at once employ in the circle in which it has occurred (and not in other circles) three peons (orderlies) and three scavengers—as additions to the existing observation staff. The preventive staff "shall visit every house in which cholera has occurred, and shall use the greatest care in seeing that all choleraic vomit and excreta are at once collected in separate vessels mixed with carbolic saw-dust (1 part of carbolic acid to 10 parts of saw-dust), paddy husk or other combustible matter, and where necessary with kerosine oil, and thoroughly, completely and immediately burn on or near the premises. . . . The Chairman shall delegate to the senior medical officer of the town and to such others as may have to act under this Rule, his power of entering and inspecting houses.

"Rags, clothing and bedding stained with vomit or excreta should be similarly burnt upon the spot, under the same precautions, the danger of keeping such articles being fully explained to the owners and full compensation in money or kind being offered in the case of the really poor, or where the owners or other persons concerned so desire, the clothes and bedding may be boiled in disinfectants and returned to them."

Whilst patients are informed that medical aid and, for the poor, medical comforts are available gratis, the sanitary staff make it clear to householders that their liberty of action in the treatment of the patient will in no way be interfered with; as a result, the representative of curative medicine in charge of the case is often the indigenous *hakeem* or *vydeen*, whilst East meets West in the person of a well-educated Certificated Sanitary Inspector, in charge of the public interests of applied hygiene. The receptacles containing carbolic saw-dust for vomit and excreta are supplied gratis to all, the necessity for careful collection being impressed; the contents are dealt with by members of the staff calling at individual houses at regular and short intervals. Special receipts are given for clothing

and articles to be disinfected, as suspicion as to disposal of these leads to cases being concealed. These apparently trivial details as to medical treatment and disposal of clothing are of primary importance in working this whole system. Once the inhabitants are convinced that in these matters their private liberty is not interfered with, our experience has been that they willingly bring cases to notice for sanitary care.

Medical Relief.—As to Medical aid, it is ruled "there shall be a head-quarters in each division (shown on the map made under the Rules) at which a medical subordinate shall reside, who shall be supplied with medicine and medical comforts from the municipal hospital for the treatment of those attacked, and who shall be available for attendance gratis on the sick in their own houses. This shall also be the head-quarters of the Divisional Inspector and of the preventive staff on night duty."

In one part of the town at least, it is required that an isolation hospital with separate accommodation for male and females of voluntary patients be provided, and furnished with necessary staff and equipment.*

Thus it will be seen that, in all matters, the staff engaged on curative duties is kept distinct from that employed on preventive measures.

These rules, originally promulgated in 1895, recognized the convalescent cholera patient as a "carrier," although to a more limited extent than the recent useful investigation by Major E. D. W. Greig, I.M.S. on this subject now warrants. In a note appended to the rules, it is stated "it is most desirable that the excreta of a patient for at least ten days after he has recovered from an attack should be carefully collected and disinfected and carried away. These still contain cholera microbes." A special type of air-tight iron excreta drums is then prescribed. In the extract from the "Simple Sanitary Rules," utilised for hand-bill distribution, as well as in the preamble of the official rules, the danger which has of late been under increased observation of allowing flies to settle upon food, and the use of cold cooked food is duly adverted to. It need hardly be added that they contain the usually recognized precautions of using none but boiled water for drinking and domestic use, the boiling of milk, eschewing unboiled vegetables, etc.

As to results secured by this system, it was found three years after its adoption that in twenty-four towns, having an aggregate population of 987,835, accepting the rules the average cholera mortality was ·97 per mille less than in those who had not utilized it, viz., 21 towns with an aggregate population of 428,914. This may be regarded as a small life-saving result (2,874 lives in three years), but as the population

*Under the Madras District Municipalities Act, when a Hospital is provided, the Chairman on a medical certificate may direct the removal of any person "suffering from a dangerous and infectious disease, who is, in the opinion of such medical practitioner, without proper lodging or accommodation, or who is lodged in a room occupied by more than one family."

dealt with is large, this fraction, if a continuous factor, represents no inconsiderable gain; it being understood that the difference of procedure in the two groups of towns consisted not in having in one of them no organization whatsoever, but simply that, in the 24 towns, *the preliminary observation* and details of organization which the rules enforce were promptly acted upon.

A District with and without an Organization against Cholera.—A remote as to time, but none the less decided, illustration of the benefit of organization against cholera is on record, in respect to the district of Kurnool, in the Madras Presidency. The District and Medical and Sanitary Officer (W. G. King), during the period 1884-'89, arranged, in the presence of cholera advancing in the neighbouring districts, to meet it by specially training lay Sanitary Inspectors for the work, on the system of circle observation and prevention adopted in later years in the above rules, within the headquarter municipal town, aided by circle inspectors in charge of rural areas. He had the great advantage of being supported heartily by successive chief Civil Officers of the District, with the result that Village Heads were not only prompt in reporting cases, but in seeing that in areas "imminently threatened" petty general sanitary measures required of them were systematically carried out. Prompt reporting was much facilitated by the free use of the telegraph of a private Irrigation Canal Company, whose charge radiated through important parts of the District. At the suggestion of the District Medical and Sanitary Officer, Government sanctioned that a direct system of intercommunication between neighbouring districts showing advance of infection should be established. The following was the result as compared with the surrounding Districts, where other methods were in use:—

Statement showing the Cholera death-rate in Kurnool and its bordering Districts for six years ending 1889.

District.	Death-rate in.					
	1884.	1885.	1886.	1887.	1888.	1889.
Kurnool	0·02	0·3	—	0·2	0·6	0·4
Bellary .. / Anautapur ..	0·9	0·5	—	1·8	1·8	1·9
Cuddapah	0.5	0·3	0·03	2·9	2·0	0·4
Nellore	0·4	0·8	0·2	1·0	1·2	1·3
Kistua	1·0	3·1	1·8	1·5	2·2	2·4

In 1890 the officers concerned were no longer in the district and, apparently, less sanitary discipline subsequently was maintained, as, by 1892, this area was the most severely affected in the Presidency. It lost 4,866 of its population, or 6 per mille. No less than 289, or 36 per cent. of its villages were infected, against 17·5 the average of the Presidency:—

Statement showing the Cholera death-rate in Kurnool and its bordering Districts for 3 years ending 1892.

	Death-rate in.		
	1890.	1891.	1892.
Kurnool	0·1	4·8	6·0
Bellary .. }	0·03	4·8	} 2·7
Anautapur .. }			} 1·2
Cuddapah	1·80	5·5	2·6
Nellore	0·03	1·4	1·2
Kistua	0·006	2·8	2·4

An Extract from the District Medical and Sanitary Officer's Report (*Annual Administrative Report of the Sanitary Commissioner for Madras*, 1887) thus describes results :—

" Ample warning of the approach of the disease was given to all District Officers by means of the new system of intercommunication between Districts, and every effort was made by inspection on an organised plan . . . to ensure that villages were properly prepared for the campaign, and, secondly, that instant reports as to the occurrence of cholera should be secured.

" In only one village did this system break down, as the result of apathy or disobedience on the part of the Village Head. In this village the Report of the existence of cholera was delayed, and time had been given for the wide sowing of the cholera germ. Here 41 deaths occurred. Yet though the disease was introduced into village after village, in no other case did it appear to get beyond reasonable chances of control. . . . As far as my experience during the several epidemics that have occurred during my service goes, I am of opinion that the spread of epidemic cholera is in inverse proportion to the amount of care that has been bestowed upon sanitary measures."

Organization against Cholera in Bengal.

In the *Indian Journal of Medical Research*, 1913, October, Vol. 1, No. 2, Dr. T. H. Bishop, the Chief Medical Officer attached to the Lower Ganges Bridge Construction Works, describes an organization by which he attempted to prevent the labour being victimized by cholera.* He placed both banks of the Ganges under observation; one area, Nadia, measured roughly 55 square miles, the other, Pubna, 33 square miles. The staffs consisted of one Assistant-Surgeon in charge and three Sub-Assistant-Surgeons, each in subordinate charge of a sub-division. The areas embraced numerous villages, with an aggregate population of 37,337. The staff undertook general sanitation, inspection and enquiry as to infectious diseases, with special reference to cholera. They made a point of teaching households the prime facts of cholera prevention. Birth and death registration also occupied their attention, so that Dr. Bishop is able to give a table exhibiting birth and death rates for two successive years showing that whilst in 1910, in the Pubna area, there were 693 attacks, in 1911 they declined to 503, and to 103 in 1912; whilst eight only were recorded in the first six months of 1913. In the Nadia area, in 1910, there were 489 cases, in 1911, 332, in 1912, 103, and 16 in the first six months of 1913.

*The working of the Cholera Prevention Scheme on the Lower Ganges Bridge Construction.—*Indian Jl. Med. Research.* 1913. Vol. 1. pp. 294-309.

He thus describes the condition of villages in the Nadia area:—"Most of the villages are situated in dense undergrowths with pools of stagnant water here and there. These conditions are aggravated in the rainy season, and malarial fever abounds. The roads and the villages at this time of the year are a mass of slush, and such open spaces as may exist without jungle are littered with human excreta." A rural area of this character is certainly one ripe for sanitary reform.

Under the advice of Dr. Bishop's staff village water supplies were mproved, food supplies were inspected, and preventive action against small-pox and chicken-pox was undertaken, as well as anti-malarial measures and quinine prophylaxis.

The Government of India whilst approving of executive sanitary staffs in municipal areas has not encouraged their extension in rural areas—they being of opinion that the spread of Elementary Education will, in course of time, secure an automatic demand from the large population involved. That is a matter of policy which is beyond our scope to discuss, but it is noteworthy that Dr. Bishop's scheme though nominally on account of cholera was analogous to complete efforts by a rural sanitary staff; although he elects that its success be judged by the test of decrease of that special disease. The conditions which may determine epidemic years being put aside, there can be no doubt that he has been able to give a useful and practical illustration of the life-saving influence of sanitary staffs in rural areas. His improvements of water supplies more especially must prove of permanent value. In this direction, tube wells were freely used.

Either by choice or as the result of no trained sanitary inspectors being available as yet in Bengal—although this will shortly cease to be the case so far as urban areas are concerned—the staff employed was medical. Irrespective of the fact that a staff which has not specialized for sanitary work is not the most suitable instrument for disease prevention—although medical knowledge makes an excellent foundation for their training—there can be no doubt whatsoever that men detailed for sanitary duty should not also undertake medical treatment of cases. To permit this is at once to put an end to sanitary surveillance in the interests of a community, to benefit an individual. The condition would correspond to a fire brigade concentrating attention on a single room, whilst a fire is spreading to the neighbouring streets. This conviction was probably also to some extent forced upon Dr. Bishop; as he insisted upon his staff confining their treatment to cholera cases.

Dr. Bishop does not state whether or not the men employed by him were mounted. This is essential in the case of rural sanitary staffs, not only on account of increased efficiency of surveillance of the community but of economy in men and their pay. For example, in this scheme, a strictly sanitary staff might have been well smaller and consequently less expensive in relation to the area supervised.

Measures for Dealing with Cholera in the United Provinces.

According to a paper read by Captain Dunn, I.M.S., at the Madras All-India Sanitary Conference of 1912, the reporting of outbreaks of cholera in the United Provinces is expected of the civil officers but,

as the watchman of the village concerned is depended upon in the first place, intelligence is much delayed. This menial, it is suggested, is apt to wait until he renders "his usual fortnightly or weekly mortality Reports." The police station officer receiving these sends them in weekly to head-quarters, where they reach the District Magistrate. "The latter informs the Civil Surgeon, at whose disposal the only agency is that of vaccinators." Captain Dunn says:—"To cut a long story short, my experience is that no agency to disinfect wells is established as a rule until three weeks or a month have elapsed since the outbreak actually occurred, and by that time as a rule the disease s spread over a considerable area and the vaccinators are quite unable to cope with it."

In this Province, obviously, no attempt is made towards the supply of a sanitary staff; as vaccinators neither by education nor status can be so regarded. In the absence of a staff, Captain Dunn advised the use of Revenue subordinates, with the object of their treating wells with permanganate of potash and eradicating possible breeding grounds for flies. Under his system, which he suggests should hereafter be pursued, he claims to have obtained much success, and gives the instance of one District where the average deaths per day for ten days in April were 65·5, and in three successive weeks, in May, 95·1, 22·8 and 13·3. He would arrange to secure early reports of cholera cases by urgent messages, such as are employed to report dacoities.

The efforts of the author were suitable as a make-shift in the absence of a sanitary staff; and by tolerance of the civil administration of subordinate civil officers having their normal duties hampered by work not their own, it may well be that the course of the epidemic he treated was affected by his measures. It must however be remembered that it is not infrequent for cholera epidemics which are allowed to run their natural course to die out in three weeks in localities invaded.

The condition of affairs brought to notice by Captain Dunn points to the necessity for the presence of an executive sanitary staff in the rural areas of the United Provinces; but, as it was recently proposed to spend within the next five years £233,000 on Elementary Education in this area, presumably some other reason than "want of funds" dictates a preference for the use of vaccinators in cholera epidemics.

The author undertook experiments on the action of permanganate of potash, and found that $\frac{1}{8}$th grain per gallon of contaminated water was necessary to secure death of the cholera vibrio in one hour. He thinks that instruction to use 1 oz. per average well (2,000 gallons) will suffice. This is a commonly used rough estimate. Experience elsewhere, however, shows that it is a simple matter to follow a more exact method by supplying subordinates disinfecting wells with a table of quantities, based on the measurements of round and square wells respectively.

Measures for Dealing with Cholera in the Bombay Presidency.

Major H. A. F. Knapton, I.M.S., in a paper read before the All-India Sanitary Conference in 1912, at Madras, lays stress on the action of the house-fly as a disseminator of cholera. He states:—"In the Central Division of the Bombay Presidency when a case is reported

to have occurred at a village, a list of questions is sent there [presumably to the Village Head, as no rural sanitary staff exists] to find out the conditions under which it appeared, together with a pamphlet in vernacular, entitled "Simple Instructions to prevent the spread of Cholera." . . . If the advice given in the pamphlet is efficiently carried out, experience shows that the disease disappears almost immediately. . . . But the difficulty is to get people to follow the methods advocated."

Pamphlets sent to villages already in the throes of cholera doubtless have their use; but whether these can safely take the place of public sanitary measures for the suppression of epidemics may be doubted. They are probably as useful as "mantras" (spells or incantations).

The Bombay Presidency annual statistical returns for 1911–12 show that 31,549 died of diarrhoea and dysentery, against 5,817 of cholera. But there is probably here some "terminological inexactitude" in diagnosis by the Village Heads, as the vital statistics of that Presidency have exhibited during several years a suspicious tendency to very heavy returns under the head of "diarrhoea and dysentery," which may well be connected in part with unchecked cholera. The figures fluctuate more markedly with the presence of cholera than even in the Central Provinces, which is its only rival in this respect. If this be not the correct interpretation, the subject of "diarrhoea and dysentery" in these two areas of the peninsula of India deserve more attention than hitherto given.

Typhoid Fever.

Anti-Typhoid Inoculation in three Armies serving in the Tropics.

*The Americans, having convinced themselves of the utility of anti-typhoid inoculation, have not been slow in coming to the common-sense conclusion that their army should reap its benefits fully. Inoculation was rendered compulsory in the U. S. Army in 1911. In that year, there were 24 cases with 5 deaths with an admission rate of ·26 per mille, against 5·62 for a period so recent as 1904. According to the Report of the Surgeon-General, United States Army, for 1912, not a single case of typhoid occurred amongst the men stationed in the United States, Hawaii, Porto Rico, or Philippine Islands, during the first six months of 1913. Having regard to the still unsettled period of immunity, following anti-typhoid inoculation, men re-enlisting are re-immunised. The success following compulsion has thus far fully justified action; and it would seem but the logical outcome that the Surgeon-General's advice to the American Government be accepted, namely, that when mobilization of the Militia or the Volunteers for field service is demanded, compulsory inoculation should be promptly adopted.

†At present, the British authorities are content to let the acceptance of the prophylactic be optional. Nevertheless, our soldiers in India are not slow in showing appreciation of the aid in resisting typhoid which

*Report of the Surgeon-General U.S. Army to the Secretary of War. 1913. Annual Reports War Dept., fiscal year ended June 30, 1913.—303 pp. 1913: Washington: Govt. Printing Office.

†Report on the Health of the Army for the Year 1912. Vol. 54. With tables.—1914. London: H.M. Stationers Office.

WRIGHT's method has placed at their disposal; as by 1912, 90 per cent of the troops there had accepted it. In that year, the admission rate for typhoid among the inoculated per mille was 1·20 and the death rate was ·15. In 1910, a differentiation between typhoid and paratyphoid was made; so that, if these are grouped together, the admission rate would be 2·6 and the death rate ·39; contrasting forcibly with the respective rates of 6·69 and 2·69 amongst the non-inoculated.

In India, the question of fading grade of immunization is met by re-inoculation within thirty months, which is well accepted by the men. Irrespective of routine methods against spread of typhoid, the arrangement of using special depôts on the hills for observation of "carriers" till safe, must be of advantage.

The results secured in the British Army in India in 1912 form a contrast to the growing intensity of typhoid incidence in the "seventies." In the three decades following 1877, the death-rate from typhoid was respectively, 3·21, 6·29, 4·88 per mille. From 1904 improvement, which has culminated in the figures quoted, has been continuous.

*In the colonial army of France, in an effective strength of 186,034, the admission rate for typhoid between 1903–10 was 7·3 per mille, with a death-rate of 1·91 per cent of those under treatment for the disease.

In June 1911, on the advice of Professor LANDOUZY, typhoid immunisation on the method of Professor VINCENT was approved by "la commission supérieure consultative d'hygiène et d'epidémiologie militaires." That expert uses a polyvalent inoculation, on the ground that it is particularly suited to meet the various pathogenic organisms met with in the French Colonies. By the end of 1912, 930 inoculations had been performed; but it is reported that, owing to the considerable re-action with which this particular form of inoculation is attended, it has not been readily accepted by the soldiers; so that progress under the voluntary system has been slow. Owing to the scattering of the inoculated men, it is not possible as yet to say how far results have been favourable.

KALA AZAR.

Kala Azar in Assam.

†Lieutenant-Colonel Leonard ROGERS and Dr. J. Dodds PRICE, in their paper published in the *British Medical Journal* of the 7th February 1914, give the results of observations in Assam Tea Estates on the prevention of kala azar. Price, in 1895, after long practical experience, formed the opinion that the disease was a "house disease." In 1896, Rogers came independently to the same conclusion. Price put his belief into practice, by securing new houses for a batch of 150 newly arrived healthy coolies. These houses were situated within 300 yards of the lines containing the old inhabitants, who were severely affected by the disease. Within these old lines 50 of another new batch were accommodated. On the lapse of two years 16 per cent. of the latter contracted kala azar, but the 150 in the new houses remained healthy.

* LAFAGE & ABBATUCCI. Les Vaccinations Antityphiques dans le Corps d'Armée Colonial. *Ann. d'Hygiène et Méd. Coloniales*, 1913. Apr.–May.–June. Vol. 16. No. 2. pp. 479-485.

† PRICE (J. Dodds) & ROGERS (L.). The Uniform Success of Segregation Measures in eradicating Kala Azar from Assam Tea Gardens.—*Brit. Med. Jl.* 1914. Feb. 7. pp. 285-289.

Rogers then suggested selecting the healthy from amongst the number resident in the old infected lines, so as to place them with the 150 in the new quarters. In evidence of the intensity of infection in the old lines, the authors state that of 96 persons selected as healthy five had subsequently to be removed, as they showed symptoms of the disease. In the new lines, at the same period, 800 freshly imported persons free of the disease were added to the total inhabitants. At the end of 16 years, these lines remained "absolutely free of kala azar," whilst the coolies who were retained in the old lines died off. But it was noted that in this period, "kala azar spread to a 'contiguous line' inhabited by 60 healthy coolies who had worked for years on the estates."

They emphasize these results by nine similar instances, and finally state :—

"It thus appears that in the ten lines . . . . kala azar has been stamped out of a labour force of nearly 7,000 workers, after it had caused a mortality within a few years of 207 per mille. . . . . As it costs from £7 to £14 to recruit a coolie, and the average duration of the illness is at least seven months, during which food and treatment cost £4, it is clear that, in addition to the great saving of life and suffering, the financial aspect of the case to the tea industry is of great importance."

The authors consider that, as malaria was not checked by their procedure, mosquitoes or other flying insects may be excluded as causative agents; and that water can also be put aside, as the same source was used by both old infected and new non-infected lines. After showing that disinfection, directed especially against the bed bug, proved of advantage for five years subsequently in certain infected houses, they are disposed to adopt the bug theory of transmission, as supported by Captain PATTON's well known work on the subject.

In the above Report where, whatever theory be held as to transmission, the plain fact stands out that in new houses in close proximity to the old, no spread of kala azar occurred, it is to be regretted that further sanitary details were not furnished. For example, Lieutenant-Colonel DONOVAN, in the Madras All-India Sanitary Conference of 1912, whilst recounting the *pros* and *cons* of insect transmission laid special emphasis on the condition of the intestine of the sick. Of the importance of intestinal symptoms towards the fatal termination of cases, there can be no doubt whatever; and in the old days, when kala azar was not differentiated, this formed one of the symptoms which appealed to us in contrast with malaria. Hence, in such an enquiry, it would have been well to show clearly whether in collection of rubbish and night soil, there was any difference as to type of apparatus and time, between the conservancy of the old and of the new lines. Again, it is but reasonable that some explanation should be given of why transmission occurred from the old infected to a "contiguous" healthy line—especially as the distance is not stated. In regard to water supply, the evidence is not sufficient to put it fully aside; unless it be shown that the new and old coolies used not only the same water for drinking purposes but also the same bathing and clothes washing places. Lastly, it was of the greatest importance that something should have been said as to the extent to which inter-communication occurred between the infected and non-infected coolies. In a free population of this class, unless a caste difficulty was paramount, it would

not be feasible to secure that they did not occasionally spend much time in each other's houses at night and during various ceremonies and feasts, such as are common in Indian populations.

The authors made experiments as to the getting rid of bugs in huts with mud walls by burning the thatch roofs, but this failed to kill insects within the cracks. Similarly, sulphur fumigation did not meet fully requirements. We suggest that the killing of bugs could best be accomplished by flaming with powerful kerosine brazing lamps.*

Yellow Fever.

The warning by the Principal Medical Officer as to possible existence of yellow fever in Sierra Leone will doubtless not be forgotten by the Colonial Office, in connection with the recent appearance of the disease in Lagos and the not remote epidemic in Freetown of 1910. It would also seem that the nature of " vomiting sickness " of Jamaica is worthy of further enquiry. Indeed, the facts for and against endemic cases in territories under British rule should certainly be marshalled before the sitting of the International Commission on yellow fever, which is reported at present to be under discussion by the Powers; and consequently the special officer pleaded for by the Principal Medical Officer should be supplied quickly. It will be remembered that at the International Medical Congress in London, a proposal was made by Dr. J. J. Van Loghem, Director of the Institute of Tropical Hygiene, Amsterdam, that such a Commission should be advised. This was negatived by a majority of votes—the feeling being apparently that it would be a bad compliment to pay American energy at Panama; the well-merited hero-worship of Surgeon-General Gorgas by tropical sanitarians of all nations being probably at the root of this decision. But, there is at least one port outside the American jurisdiction—Guayaquil—which has been a cause of intermittent alarm to the Panama authorities for a long period both as to yellow fever and plague, and there are other ports in South America where enforcement of special sanitary measures would be of advantage. The *United States Service Public Health Reports* (1912, Dec. 13, p. 2074) refer to the fact that attention need not be turned solely to the Ports of Ecuador and, after referring to Manaos in Brazil, state :—

" In this connection, it is to be borne in mind that the reported cases of yellow fever in that part of South America north of the Amazon River give at least a poor idea of the prevalence of the disease in that region. Yellow fever is, and has been for some time endemic at Iquitos, a city of Peru on the Amazon River. It has also become endemic in many localities throughout South America, north of the Amazon. There are those who believe that the disease unrecognized is also endemic in certain localities in Central America and, possibly, even as far north as Southern Mexico, and, from time to time, reports are seen in print to the effect that yellow fever still persists in endemic form in certain of the islands in the West Indies."

The Ecuador Government, after energetic representations by America, has now voted £2,000,000 for the sanitary improvement of Guayaquil.

*See King (W. G.) " Flaming " in Prevention of Plague and Kala Azar. [Correspondence.]—*Indian Med. Gazette*, 1913. March. Vol. 48. No. 3. p. 124.

Although arrangements will be in the hands of a British firm, it is rumoured that the unique experience of Surgeon-General GORGAS will be available.

The present request for a Commission was advanced by the Netherlands Government, and has already been approved by the Government of America. As showing that no American susceptibility exists on the subject, it may be remembered that a similar suggestion was made by Surgeon-General GORGAS, in a paper read before the Fourth Pan-American Scientific Congress in December 1908, when he stated :—

"Concentrated effort on the part of the countries in which it now occurs, I think, would extinguish the disease at once, at no very great expense and without undue labour. I believe that if this Congress could get the Governments of the various countries in which yellow fever has occurred during the past year to agree to keep such an organization as I have outlined, which could be sent at once to the locality where yellow fever appears and there stamp it out, at the end of two years yellow fever would have disappeared from the Western Hemisphere."

Except *via* the Canaries and the West Indies, the future connection between the West Coast and the Panama Canal must be slight. Presumably, the Commission will not however treat the subject solely from the point of view of the influence of the Panama Canal, but will enter impartially into the question of *international means of repression of the disease in whatever area found*, as has been done in the case of cholera and plague.

PLAGUE.

Plague in Ceylon.

In discussing the comparative immunity from plague of certain areas in India, there has been more disposition to find some special reason in difference of variety of the flea and rat, and their seasonal fecundity, than to regard such possible factors side by side with the extent and nature of passenger and goods traffic (including the recently discussed question of grain transport) as modified by the sparsity of inhabited areas, their density in population, and the habits of the people concerned. The influence of the type of plague in epidemiology has been overshadowed by the preponderance of the bubonic form, and local departures from this have been merged into matters of "minor epidemiological importance." Hence, the recent outbreak in Ceylon has special interest.

About the 12th January, 1914, there occurred a series of deaths on the north side of Sea Street, which faces the harbour of Colombo. These were returned as due to meningitis, pneumonia, and lymphangitis. There had been no rise in mortality, according to the statistics for the town generally. A communication was, however, received by the Health Officer on the 24th January as to a "mysterious disease" in the locality; when he caused immediate investigation. A house-to-house inspection was carried out. No death or case of suspicious illness in human beings was found; neither were any dead rats or evidence of unusual sickness or mortality amongst them discovered. As the area was under charge of an overseer engaged in rat catching, his evidence, which confirmed this state of things, was of some value. On the afternoon of the 25th, a "sudden death" was registered after high fever of less than one day's duration, a statement which is supported by evidence that "the deceased had been seen going about

apparently well the previous evening." Dr. CASTELLANI, in the absence of the Municipal bacteriologist, was present at the post-mortem, and took samples for examination. Pending his results, which subsequently confirmed the suspicion of plague, energetic operations both as to human beings and rats were conducted.

Reporting on the 18th February, the Colombo Municipal Officer of Health, Dr. Marshall PHILIP, D.P.H., states that the whole 23 cases of plague reported in Colombo up to that date have been septicaemic in type and have been fatal. Only two of these have been females, and 74 per cent. of the males were under 25 years of age. Five persons found dead were ill less than 24 hours (evidence not fully reliable).

At the post-mortem of the first case, there was an entire absence of anything abnormal, beyond slight congestion of the meninges; there was no evidence of haemorrhage, nor of enlarged glands, nor was there any congestion of organs. In two subsequent cases there was intense congestion of the lungs and meninges, but again there was no sign of haemorrhage or enlarged glands.

Between the 18th and 25th February, 15 further cases of plague occurred—all of which were fatal. A case was also reported to have occurred in a village thirty miles from Colombo. Of the total cases up to 25th February, *only one was bubonic axillary.*

There was no lack of rats in the infected quarter, as the Medical Officer of Health reports that, in one night, 564 were captured, of which 159 were from Sea Street. He notes that many of the houses are connected directly with the drain, and that in these rats are numerous.

Between the 1st and 18th February 54 rats were examined by the municipal bacteriologists, of which four were considered to be plague infected, whilst the Director of the Bacteriological Institute found two infected out of 115 rats. The official reports, so far available, do not give the date when the first rat was found infected; but, according to an "Associated Press of India" telegram, no rat was found infected until February 11th. Of a total of 22 rats found infected up to the 25th February, 11 belonged to "the species *rattus* (house rat), seven were *norvegicus* (sewer rat) and four *musculus* (mouse). This is an unusual proportion of infected *sewer* rats, due no doubt to the very frequent connection which exists between the old underground drains and the interior of the houses. The first infected rat found was a sewer rat. Sulphur fumes blown into rat holes in houses frequently cleared the drains."

The following is the statement of the probable origin by the Medical Officer of Health:—

"The source is not known. The infection may have been introduced in any one of a variety of ways; but, as it is practically certain that the first known case was not actually the first, it has been found impossible so far to arrive at a definite conclusion. It may have been introduced amongst infected articles, or an infected rat may have escaped from some ship in the harbour and found its way up one of the numerous old underground drains, which run from Sea Street to the Harbour, and which are neither trapped nor guarded, or which seems the most probable, an infected person may have brought it in from India."

Postscript.—The following is the summary of the events in the plague epidemic in Colombo:—There were 12 cases held to be suspicious of septicaemic plague between the 12th and 24th January. On the 25th the first case of septicaemic plague

was diagnosed. In the total of 46 cases, up to the 26th February, nine cases were bubonic. Since that date and up to the 10th March, 25 cases have occurred in which the differentiation of bubonic cases is not stated, but which it is believed are in the main septicaemic. The first plague infected rat was found on the 5th February.

A remarkable feature of this epidemic is the septicaemic type of the disease; and interest naturally settles round the opinion of the Medical Officer of Health (Dr. Marshall PHILIP) supported by Dr. CASTELLANI* that whilst invasion by infected rats or rat-fleas is possible, introduction by infected man was probable.

The best available evidence on which to test the question of probable cause is that placed on record by the Indian Plague Investigation Committee. Their valuable and elaborate experiments and observations have established to the full the important rôle of the rat flea. Their arguments would, however, go to show that whilst other factors may exist, their consideration in plague prevention is academic. They would teach that man (except as a carrier of infected rat fleas) as a factor in importation of the disease to new localities may be ignored, if not infected with plague of the pneumonic type, when at the worst he might start, in the climate of India, a few similar cases easily repressed. It is well, therefore, to discuss the pros and cons of their attitude in connection with the suggested probability that the epidemic preceded the epizootic.

The drains of the infected houses, neither guarded nor trapped, led to sewers infected with rats. In drains of such nature it would be an easy matter to dispose of discharges, and rags used in wiping them from the sick. The presence in septicaemic cases of bloody mucus with faecal matter and, at times, of blood in the discharges from the mouth and nose must be expected. The Commission experimented by rat inoculation in only 16 cases with human faeces, and in these they carefully excluded blood. When they did get one successful result they blamed their technique as faulty; and there left the matter. In feeding experiments, they chose to regard urine as representative of both the solid and fluid excreta of man in their natural state—thus excluding, not only undigested grains, but blood and mucus in mass as tempting morsels. They admit that the soft feeding of rats would infect and that accidental abrasions are a danger; but because the well-fed and largely immune rats of Bombay, unless fed in laboratory precincts, do not get mesenteric buboes, they exclude infection by feeding in nature in other localities where they may be less well fed; and place all neck and sub-maxillary buboes, which may also be caused by feeding, to the credit of the rat-flea. Recently contaminated floors, they grant, will infect the rat, but pneumonic sputa which are supposed to be crowded with plague bacilli, and bloody discharges of septicaemic cases, do not appeal to them as necessary items in experiment. Either they take refuge in the requirement of floors being "grossly infected," or regard such matters of no import in epidemiology; presumably in the belief that rats will not elect to pass over floors stained with pneumonic sputa or septicaemic discharges till at least six hours after the deposit! As to pneumonic sputa no feeding experiments are on

*CASTELLANI & PHILIP. Plague in Ceylon.—*British Med. Jl.* 1914. April 4, p. 752.

record by them, though Dr. BROQUET in Manchuria infected one in four rats thus fed. Six per thousand rats examined by them had pneumonia (no mean number in huge rat populations), but no effort to imitate inhalation by rats of dust laden with partially dried mucus entangling microbes is recorded. The question of conveyance by flies and ants of discharges fresh or semi-dried, but still infective, to human food has never been touched by them; apparently because they do not take cognizance of the everyday fact that the labouring classes of India (at least in the South) make a light early morning breakfast of *cold food cooked the night before*, when, in mouths abraded by sticks in cleaning their teeth and the cleansing of the tongue and throat by no gentle thrusting of hands into the oral cavity, there should be no difficulty (putting aside the more disputable question of intestinal infection) in securing infection by the mouth and throat and thus septicaemic plague, or neck buboes, without the intervention of the rat-flea. In considering the possible influence of the human flea in contaminating hands, VERJBITSKI'S insistence that "clothing and bed-clothes which are covered with material from infected insects obtained either by crushing them or from their faeces can serve during a long time as a source of infection" need not be put aside. In this connection it must be remembered that 74 per cent. of the sufferers up to the 25th February were of the lowest class of Tamils below 25 years of age, and, with the exception of two, were males—bespeaking the daily labourer living under very poor sanitary conditions.

But is there no possibility of human or rat-fleas becoming infected by human septicaemic plague? Again, the Indian Commission put the matter aside as theoretical. They made a microbe count in the blood of cases of septicaemia in human beings. They admit that the condition fluctuates in individuals, but they have hitherto made no attempt to decide the variation of intensity in types of the disease; yet it is held by some authorities that bacteraemia is most marked in the pneumonic type. So far as can be judged by the context, it is probable that the cases used were bubonic approaching a fatal issue. There is nothing to show what might happen in septicaemic and pneumonic cases towards the end. However, they found the proportion of *B. pestis* was in 7 out of 26 cases above 10,000 per c.c. and in one case over 1,000,000 per c.c. The impression they desire to convey is that the flea has but a remote chance of fishing a single microbe from such a blood stream. Now, as a flea's stomach capacity measures, according to them, ·5 cub. millimetre (·38 to ·48 cmm.) why should not the human flea gain, say, 1 to 50 at one meal, and, as it feeds from time to time and bacilli increase in its stomach and tend to remain there, why should it not be in particular types and stages of plague an occasional danger to man as a natural host and as a host of accommodation to rats? At any rate, it is satisfactory to know the Commission obtained an infected human flea in nature.* Curiously enough, so far as we have been able to ascertain, they have not placed

* In an experiment with clothing from an infected house, this flea was arrested by tanglefoot on its way to attack the rat prototype—the guinea pig; at the same time, two rat fleas and one human flea were found on the 26 guinea pigs employed. A just inference is that an infected human flea may attack a rat, and thus start an epizootic. (See *Jl. of Hygiene*, 1907, Dec., Vol. 7, Plague No. p. 889.)

on record a single experiment of attempting to convey septicaemic blood from man to a rat by either rat or human fleas; although in the case of bugs this mode of experiment was used with success by Capt. E. A. WALKER, I.M.S., in Burma*. Experimentally, using the rat instead of the human being as the source of plague, they, however, conveyed infection by the human flea to rats in 3 out of 38 experiments. But, as to the rat-flea, they show it will readily attach itself to man and, even in the presence of rats, if food supply be limited, it will bite him. Of course, this is best exemplified by the death of the rat, and hunger consequent on absence of its natural host. As it happens, in the present case, there existed a combination of factors in nature for inducement of the rat flea to bite man. The area first infected was one which had been recently worked over by ratcatchers, and, consequently, hungry rat fleas might have been present on floors in unusual numbers at the time of receipt of the first imported human case. Such consideration does not, however, diminish the importance of infected man as one of the importing agents capable of starting an epidemic and ultimately an epizootic. Of course, with flea exclusivists, it is a simple matter to dismiss our mode of regarding the subject with the suggestion that, even if there be any foundation for believing there are other factors than fleas and rats concerned in importing plague, they are of "minor epidemiological importance." To this we would, however, reply that the sanitarian is concerned with *prevention*, and, if a minor factor in epidemiology is capable of ultimately putting a major factor (an epizootic) into operation, it is his plain duty to predetermine the best available and reasonable measures to inhibit it—not to ignore it.

We have encountered persons who have asserted that nothing but bubonic plague occurs in the South of India, from which area Drs. Castellani and Marshall Philip suggest infection may have been derived. But, as a fact, both septicaemic and pneumonic plague have been present in the Madras Presidency, and, in certain epidemics, this markedly has been the case and, as in Ceylon, they have *preceded* bubonic plague. Nor in that area, in well-watched populations, do epizootics always precede epidemics; though the former ultimately determine the extent of the latter. On such grounds, we consider that the evidence as yet furnished by the Indian Plague Commission does not suffice to negative the interpretation (with which we agree) of the local officers as to the "probable," as contrasted with the "possible," modes of introduction of the epidemic.

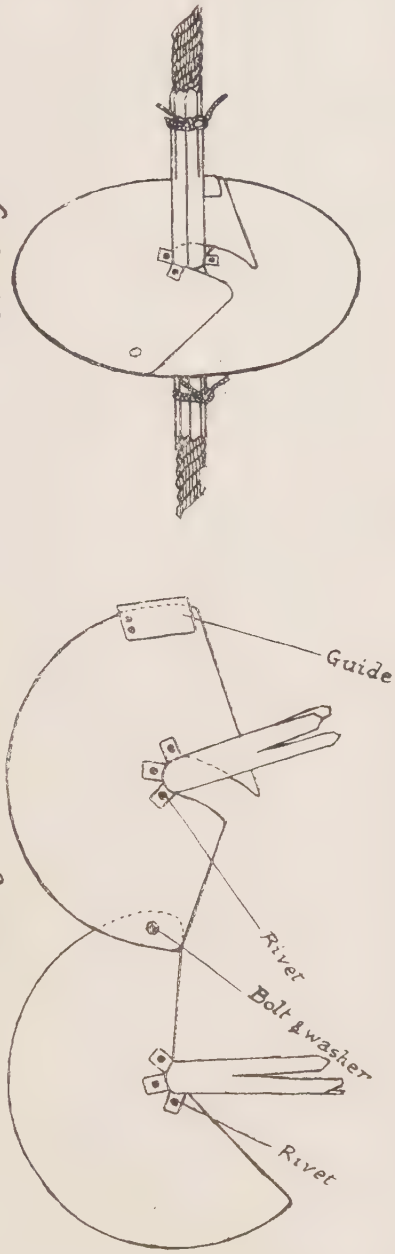
Rat Guards for Ships' Lines.

Passed Assistant Surgeon Carroll FOX† states that, as a result of many consultations by officers concerned in the Philippine Islands, there has been adopted a guard for ships' lines, which he considers to be "an effective barrier against the passage of rats"; whilst it has the further advantage of being "cheap," readily applied, light, and not easily

*WALKER (E. A.). Transmission of Plague in the absence of Rats and Rat-fleas.—*Indian Med. Gaz.*, 1910. Mar. Vol. 45, pp. 93–94.

†FOX (Carroll). The Rat Guard used in the Philippine Islands.—*U.S. Weekly Public Health Repts.*, 1912. June 7. Vol. 27. No. 23, p. 907.

made unserviceable by hard usage." The following is the description given, as well as the illustration of the guard :—



A rat guard for ships' lines. (Diameter of disc 3 feet. Made of heavy galvanized iron with copper rivets. For use on lines up to 4 inches diameter).

"The special features of the guard are these: A single disk in two parts with arms (funnels) from both sides. It is hinged by bolting at the periphery of the disk. There is a guide permitting a perfect opposition of the two parts of the disk when closed. It is adjustable to many different sizes of rope and when placed on the line fits closely by tying on both sides. Rivets are used throughout, thus increasing the strength. The distal portion of the arms is cut longitudinally into three strips so that they may be bent to come into immediate contact with the rope when tied.

"The details of construction as worked out after considerable experience are as follows:—Flat sheet galvanized iron is used for all parts of the guard ; 20 to 24 gauge answers best, for that weight of iron is strong enough and does not make the guard too heavy. The shield should not be less than 3 feet in diameter. The funnel tubes should be 18 inches long on each side of the shield. The central aperture can be made to fit any size of rope. One made for a 3-inch diameter rope will serve for all smaller sizes. When made or used for encircling a number of lines at the same time the shield should be 4 feet in diameter and the funnel tube enlarged and supported by five flanges and five rivets instead of three. The guide piece, which is the one important feature of this guard, is riveted on one side only and then bent around the circumference. The rivets which fasten the funnel tubes go through the tube flanges on each side of the shield. One bolt, two washers, and five rivets are needed for each guard. When badly damaged by use or carelessness, a block of wood and a hammer are all that is required to restore the guard to its former usefulness."

Guinea Worm.

This disease, which is of importance as a cause of labour disability,*

*Under the head of "Parasites," guinea worm accounted for 60 per cent of cases in the Hospital Statistics of the Gold Coast Colony in 1912.

has received considerable attention from Dr. TURKHUD, according to the Report of the Bombay Bacteriological Laboratory for 1912. In famine camps, in the District of Dohab during March 1912, 2,000 cases of guinea worm were found.

At the All-India Sanitary Conference of 19th November 1912, Dr. Turkhud* made the following interesting statement :—" In our experiments at Parel, guinea worm larvae were also found inside stegomyia larvae, but whether they undergo any other further developments in the host is still to be ascertained." He showed that the cyclops follows the embryo and secures it for ingestion, and that the embryo does not pierce the integument to secure entry—thus confirming LEIPER'S observations. In contrast with LEIPER'S work, he obtained no infections in experiments upon twelve monkeys. These have been repeated, and in due time results will be reported. Enquiries in infected villages elicited the information that no instances of guinea worm in cats, dogs, goats, hens or cattle had come to the notice of the people, although these animals partook of the same water as the infected inhabitants. Five persons volunteered to drink water containing infected cyclops. Eight months to a year must elapse before results can be reported.

To this record of experimental data may be added one of ancient date. Assistant Surgeon LORIMER of the Indian Medical Service, in 1838, inoculated himself and four others with the " fluid of the grown guinea worm." Although " the favourite site of ankle " was selected, no result occurred. The necessity for the cyclops as an intermediate host was still to be discovered by FEDESCHENKO.

On visiting infected villages, Dr. Turkhud was able to demonstrate the guinea worm's embryo in the cyclops in 44 out of 114 examined, which is stated to be the first finding of this condition in nature.

He described the method of infection to the villagers, who appeared impressed ; but, when it came to altering a well so constructed as to allow them to stand directly over its mouth in drawing water, they objected to its being interfered with, because they feared they would lose their legal rights over it. Such statements are liable to be brought forward as evidence that inhabitants of rural areas in India oppose sanitary advance. The villagers were probably not without some legal ground for thinking that to abandon a well to be repaired by a Public Body, would thereafter touch their private rights. The civil officer in charge of the Taluk, acting on behalf of the District Board, required a petition from the villagers asking to have their well repaired, which under the circumstances was not forthcoming.

The matter is really not one where the sanitary instincts of the people should be in question. Dr. Turkhud had to deal with a condition in which legislation of a nature not invalidating private rights, yet securing the discretionary action by a local sanitary authority, in the public interests, would seem to be requisite. This attitude the Bombay Local Boards Act as well as the Bombay Village Sanitation Act fail to secure. In the Madras Presidency, however, under the Madras Local Boards Act, the matter could have been settled without

*TURKHUD (D. A.). Dracontiasis.—*Proc. Second All-India Sanitary Conference.* 1912. Vol. 3. pp. 118–120. (1913. Simla : Govt. Central Branch Press).

friction. As the clauses concerned give control not only over private wells and tanks but private streams and channels, in a manner obtainable in some countries only by complicated legal methods, if at all, they are quoted. The penalty of interference by a Public Body of having to pay for alterations, etc. is a light matter, when balanced against the saving of life rapid action may secure :—

Section 99, Madras Local Boards Act, V of 1884.

"The President of the Taluk Board, or any person duly authorized by him in that behalf, may require the owner of, or the person having control over, any private stream, channel, tank, well or other place, the water of which is used for drinking, to cleanse and maintain the same in good repair, to provide parapet walls for the same and also to protect any such well from pollution by surface drainage in such manner as he thinks fit, or whenever the said water is proved to the Taluk Board to be unfit for drinking, to desist from so using such water, or permitting others so to use it, and if, after practice, the water of such well, tank or reservoir, is used by any person for drinking, the President of the Taluk Board may require the owner or person having control thereof to close such well, tank or reservoir, in such manner as he may direct, so that the water thereof may not be used for drinking."

In the recent All-India Sanitary Conference, at Lucknow, the question of treatment of water infected with guinea worm was discussed. Dr. Turkhud's recommendation of protecting wells from surface flow and from villagers climbing into or standing over them is of course self-evident, in view of the tendency to get rid of the embryo which the female guinea worm exhibits under dropping water—a method formerly used clinically. One good authority suggested the use of permanganate of potash, but the short account of the discussion so far received points to this as an untried suggestion only. Indeed, the question of treatment of guinea worm infestation by permanganate of potash and other methods is evidently one requiring further experiment. Personally, we have in such cases advised the complete emptying of the well, a matter usually easy of accomplishment where bullocks, irrigating leather buckets (doles) and picotahs are available ; the steining and surroundings of the well were then well cleansed, and all rags found were burned. After the admission of the water, sedimentation by the addition of alum 4 to 6 grs. per gall., with added lime gr. 1 per gall. if a soft water, was employed, on the theory that the structure of the embryo would suffer, as well as be enclosed, by contact with alumina hydrate before deposition. This method, if proved by laboratory experiment effective, would be easily applicable to Indian villages : as alum is obtainable in bazaars, and its utilization for water clearing is of indigenous origin, and one to which therefore no objection would be raised. In one instance, in a village visited after a lapse of a year where this mode was used, the measures were stated to have been beneficial by the villagers. Possibly, both the guinea worm embryos and the cyclops would object to the presence of hypochlorite of lime.

Irrespective of the radical measure of boiling, a useful direction which appeals to villagers is the securing of a mutual understanding that persons with protruding guinea worm should not be allowed to draw water, whilst bathing in the vicinity, and the deposit of dirty leg bandages which often accompanies the act should be deprecated. On this point, also, there would seem room for experiment. Dr.

Turkhud points out that filtration through a cloth is an effective preventive, and as this is a method commonly practised by Indians when filling their water vessels, it should be decidedly useful. But it would be of interest to know if such cloths were kept damp—the chances being against this in a hot climate—how long the attached infected cyclops or guinea worm embryo would be a danger, if the cloth were reversed in the next act of vessel filling. It would also be of advantage to ascertain how long embryos on rags carelessly disposed near a well, and therefore kept damp, might await in a living condition entrance by surface flow, or attached to ropes and feet, into an unprotected well.

Having regard to LEIPER's observation that acid solutions of ·2 per cent. free the embryo from cyclops, it would be also advisable to experiment with "acetization" of the contents of wells, as suggested by Dr. MATTHEWS, Assistant Health Officer, Madras City Corporation, against cholera. A further suggestion by Dr. Leiper is also worthy of careful investigation, namely, the use of steam in raising the temperature of infected water as found in definite masses such as wells. As a result of laboratory research, fortified by consultation with Mr. STANLEY PHILLIPS, Lecturer on Physics, Birmingham Municipal Technical School, he has suggested* that complete purification can be secured by raising water to a temperature of 65° C. This can be managed by inserting the nozzle of a pipe deep in the water and passing steam through it, a measure which would imply the use of no greater apparatus than a portable steam boiler, and would therefore be frequently available, even in rural areas. In the matter of prevention also, itwould seem likely that the stocking of infected wells with certain fish would get rid of the cyclops. To the experiments with monkeys, the tracing of what happens to infected cyclops when devoured by fish might well be added.

Dr. Turkhud's enquiry is of a practical nature that cannot fail to be of advantage to employers of labour in India and Africa.

VACCINATION.

Vaccination on the Gold Coast.

The Medical and Sanitary Report for the Government of the Gold Coast, 1912, recalls the fact that Dr. LE FANU demonstrated in 1909 the possibility of animal vaccine being cultivated at Accra. This was followed by the making, at that place, of a small Vaccine Depôt, which enabled Dr. J. W. O'BRIEN in 1911 not only to issue lymph but to conduct experiments on the best method of its transport. He considered that the local product gave results superior to imported lanolinated vaccine or dried lymph sent from England and Germany, respectively. On referring to the latter officer's Report, it is evident that his opinion was formed after troublesome investigation; but establishment of a claim of superiority of one or other method of preservation under tropical conditions can hardly be said to have been secured by data at his disposal. Thus, whilst the age of the locally produced

*LEIPER (R. T.). A Method for Dealing with Town Wells infected with Guinea-worm.—*Jl. London School of Trop. Med.* 1911–12. Vol. 1, pp. 28–30.

vaccine is stated, as well as its method of storage before issue, similar information is absent as to the vaccine preserved by the other two methods—the date of arrival in the Colony only being mentioned. In the statistics of the total cases vaccinated, nothing is said as to whether the percentage reckoned upon is the number inclusive or exclusive of the "unknown"; whilst the totals and percentages of success of lanolinlated vaccine, from lack of details in the text, cannot be co-related.

Putting these details aside, the point of value in the work of Drs. Le Fanu and O'Brien is the establishment of the feasibility of conducting animal vaccination at Accra, and rendering this a centre of distribution, thus securing an economy when contrasted with the cost of importation. Further, inspection of the meteorological tables proves that the climatic conditions of Accra should present no special difficulty as to cultivation of animal vaccine, provided proper buildings were at disposal. Indeed, the history of the establishment subsequent to Dr. O'Brien's Report would show that the chief trouble to be encountered is the irregularity of the supply of calves; and either for this or other reason it is reported that "very little locally made lymph was used during 1912."

We have referred to the previous history of this subject, in respect to the following remark, at page 19 of the Report, made by the Senior Sanitary Officer as to inoculation of calves:—"After an interval of 72 hours, vesicles are scraped off, and the material so collected is weighed. . . . It may be stated in explanation of the early period at which the vesicles are collected from the calf (72 hours) that vesiculation occurs at an earlier period than with the home lymph, and that a longer interval allows pustulation to occur." The success rate on the human being is said to have been 87·94 in 2,378 cases. This rate is by no means poor, having regard to difficulties of transport to outstations; but as, unfortunately, according to the reporting officer, "the table does not separate primary from secondary or other vaccination," it is hardly possible to gauge the success rate of the particular vaccine. It is also not stated to what extent figures are supplied by incompletely supervised native vaccinators. Accepting however the figures as thus qualified, it must be said that the continued use by transfer to the calf of animal vaccine which matures at 72 hours, and thereafter runs to pustulation, contrasts strongly with Indian experience, where the process of cultivation is conducted in certain places having higher temperatures than at Accra. Under such climatic conditions, there is always a tendency to advancement in hours of maturation; but, by selection of typical vesicles and the use of fit animals, and scrupulous care of their environments, it is possible to restore the strain to a better approach to the normal maturation of 120 hours. Indeed, a strain that, in addition to advancement, to the extent reported as existing at Accra, tends to suppuration, would be promptly discarded as no longer typical of sound vaccine.

So far as we know, no observation exists, as to whether persons vaccinated with such atypical animal vaccine are less securely protected against small-pox, as judged by duration of immunity, than if typical material were employed; yet some analogy may be found in the younger age at which re-vaccination of the adolescent is advised in the present day; it being held by some authorities that duration

of protection has diminished, owing to degeneration of vaccine stocks following long transmission away from their original sources. Be this as it may, unless full evidence be available to the contrary, it would seem desirable to issue no vaccine for public use that does not correspond more closely than that used at Accra with accepted standards of type and vigour of animal vaccine. Until such proof be forthcoming, it must be concluded that the present vaccine stock at Accra has degenerated, and that its renewal is necessary. If particular difficulties are experienced in maintaining a stock of standard vigour, on animals that are not easily controllable apparently owing to little domestication, it would seem better to rely upon imported vaccine entirely for *transmission of stock* on animals, *so as to avoid local transfers to a second generation.* This method, at very little expense, would get rid of many difficulties, and would in no way interfere with local methods of vaccine collection and preservation.

The Report records that trouble is experienced owing to infestation of calves by ticks. Animals so afflicted are not desirable, as their grade of health is often low, and the bites on the abdomen are liable to get accidentally inoculated during lymph insertion, and thus give excessive and irregularly placed vesicles. If no choice is possible in the matter, the ticks should be got rid of and the animals be brought into general condition by judicious feeding. Irrespective of patent "dips," in which the active agent is usually a preparation of arsenic, kerosine soap mixture, or solutions of the various tar-derived disinfectants, will get rid of them. Practically as efficient as these, however, is the use of a weed, the *Leucas cephalotes* (Spreng.) as used by Madras ryots. This is pounded so as to make a mash and is well smeared over the animal. This weed is probably widely distributed in the tropics.

The Organization of Vaccination Departments.

In certain areas of our possessions in both East and West Africa, the question of supply of animal vaccine has attracted the attention of workers, but still demands final settlement. In the meantime, the important point of how to use anti-smallpox vaccine with efficiency amongst scattered native populations, and secure from those concerned accurate reports of results, so that the protection of communities may be gauged, remains a much neglected problem. The policy largely pursued has been to reach the native in rural areas, by haphazard methods at the hands of little supervised native vaccinators, and then to expect them to believe so implicitly in the British "Ju-Ju" as to discard inoculation and other injudicious customs. Yet, it would seem essential that in dealing with a population possessed of views as unfounded, but probably quite as strong, as those of British anti-vaccinators, details of organization should be of that complete nature that should ensure the gaining of faith *pari passu* with the offer of the prophylactic method; even if finance limited first efforts to a few square miles, so that failures to protect should not become an advertisement of inefficacy. Where native vaccinators possessed of poor general and technical education and without close inspection by special officers are solely employed, expenditure in providing good lymph will not secure efficient vaccination. The negro certainly does not show any immunity against small-pox; hence, it seems paradoxical that so much effort should be made to prevent him dying from

malaria or sleeping sickness, whilst he is left largely to his own devices in respect to that terrible disease. In short, in parts of East and West Africa where it is deemed that well conducted vaccination will be tolerated by the natives, Vaccination Departments should be placed on a sound basis of trained technical *personnel*, having a definitely estimated relation to area and population.

This necessity for improved methods for organization in the territory of the Gold Coast Government is thus forcibly referred to by the Senior Sanitary Officer (Thomas C. RICE) in his Report of 1912 :—

"I am convinced that a determined effort should be made to secure the efficient and systematic performance of vaccination in a manner that will impress upon the natives the importance attached to it by the Administration. The subsequent disappearance of small-pox will afford evidence as to its efficacy. I advise that a Medical Officer, assisted by educated and intelligent natives, be appointed as a Vaccination Officer to each Province. When, after a few years, the bulk of the population has been efficiently vaccinated, and the native taught to appreciate its value, the work can be carried on by the natives trained by the vaccination officers—subject to occasional European supervision."

HOUSE FLIES AND DISEASE.

Flies in Delhi.

In 1911, the Delhi City (population 232,837) had a death-rate of 59·58 per mille per annum. The recently appointed Health Officer of Delhi (Major COOK-YOUNG, I.M.S.) has therefore no mean task before him. In only one matter is he to be congratulated; he is well supported in funds and influence by the Government of India, and is therefore in an excellent position to afford a good "object lesson" of applied hygiene in India. It is reported that, as a result of his efforts, the death-rate has sunk from the heavy figure stated to the still heavy, but improved annual rate of 44 per mille.

A complete sanitary survey of the city is being made; considerable mosquito reduction has been effected—so that comparison of a six months' period of 1912 with the same period of 1913, exhibits a reduction from 6,000 deaths from malaria to 4,200. Plague and cholera did not become epidemic during the year—imported cases only being detected and treated; a result that could not have been attained without untiring and close sanitary surveillance of the people. He has been able by insistence on sound conservancy to make a reduction in flies that is manifest to a somewhat apathetic public. This result is thus alluded to by the *Allahabad Pioneer* of the 11th February: —"The key-note was that the city must be clean . . . . if breeding places are found, flies can be stamped out in ten days . . . . Those who saw the troops marching through the city at the Durbar, every helmet a lodging place for a host of flies, would perhaps not credit that to-day hardly a fly is to be seen anywhere along the route that was taken, and that the reduction has been materially the same throughout the city." This is an encouraging statement from a lay paper; before, however, a decision is arrived at as to the extent of influence on flies of improved conservancy, the Health Officer's Report showing comparative seasonal meteorological conditions, and the extent to which the presence of the masses of troops and animals at the Durbar was an aggravating condition, must be awaited.

Flies in Poona.

In Poona, amongst European officials, European troops and Indian prisoners in the Central jail, diarrhoea and dysentery showed a considerable increase in the years 1911 and 1912 when contrasted with the year 1910. Investigation on this subject as conducted by Captain MORISON, I.M.S., is detailed in the *Report of the Bombay Bacteriological Laboratory for the year* 1912. He first ascertained "that the prevalence of diarrhoea and dysentery follows the increase in the humidity of the atmosphere which is associated with the monsoon rainfall, a point which has generally been recognized in previous years; and, secondly that with the advent of the monsoon flies become a pest in Poona." To gauge their incidence, he placed fly-papers in houses and studied the "fly counts" side by side with meteorological conditions. A disturbing factor in deciding these counts came to notice, in the tendency of enthusiastic householders to add papers; so that his records on this point had to be exact. Incidentally, it was found that in one house "a slight alteration of meals to accommodate a guest, who remained three days, increased the fly catch from 234 to 500, 462, 466; after his departure, the numbers fell on successive days to 296, 300, 290, and 250."

Captain Morison's observations showed that there was a close connection between fly counts and the occurrence of diarrhoea. It was however found that flies "were few in September and practically absent in the closing months of the year; so that the small epidemics of diarrhoea, which occurred among the men of the Loyal Lancashire Regiment in the fourth week of September and in the week ending the tenth of November, cannot have been caused by flies."

Nothing is recorded to show whence, if flies were the main factor, the infective agent was carried; although such suggestions as the presence of special salts in the drinking water during the rains, the milk of cattle fed on new pasture are held refuted, whilst "the presence of certain flagellates in the intestinal contents have been proved to have no relation to the disease." "The bacillus dysenteriae of Shiga and Flexner and Morgan's No. 1 bacillus were found in the stools of patients." The investigation is to be continued for another year. In the meantime, however, the apparent trend of this paper is towards a "carrier" theory.

All factors possibly connected with this outbreak will doubtless be fully considered in the final Report. We suggest that further data as to water than the presence or absence of excessive salts are desirable. A point that may prove of some importance—if the question of distance from the locality concerned and seasonal incidence do not put it aside—is that Poona is one of the few places in India where night-soil is of value, and its use is largely resorted to in a comparatively fresh condition for sugar cultivation in the immediate neighbourhood. The period of sugar cane cutting also should be held in favour by flies.

The occurrence of diarrhoea in Poona corresponds with the South-West monsoon. In the Madras Presidency, it has been shown (W. G. KING) that if the incidence of cholera according to months and the populations affected (which numerically are very different) be proportionately treated, it occurs chiefly with the S.W. monsoon in the Districts which depend upon this monsoon, whereas in the other

districts, whose chief monsoon is the N.E., the incidence is in the latter period. It would thus be of advantage, in connection with Captain Morison's tracing of association of diarrhoea and dysentery with the monsoon rainfall and fly prevalence, to make a contrast between the N.E. and S.W. Districts of Madras.

Destruction of Insects.

Mosquito Traps.

The *Canal Record* (Ancon, Canal Zone) of the 11th February* contains the description of an insect trap, invented by Mr. Charles H. Bath, Division Inspector in the Department of Sanitation, which is covered by a patent. This consists of a wire mesh arrangement that can be fitted on an opening in a room, so as to trap mosquitoes in attempting to enter or leave it; his opinion being that mosquitoes are attracted by the scent of human beings. It can be used detached and placed in position in the open, so as to use the lure of a light. It is of utility not only as to mosquitoes but flies. The apparatus utilizes the fact that mosquitoes readily enter the base of a cone, and leave through the apex passage ways which are provided, but refuse entry at the apex. The following is the account given of results when in use :—

"A series of tests conducted at the former labourers' barracks at Miraflores in 1911, covering a period of 71 days with 44 traps set in eleven barracks, and with the average of 14½ traps in use per day, showed an estimated daily catch per trap of 96 anopheles, or a total of 1,392 per day. The total estimated number caught during the entire period of 71 days was 98,832. One of the traps that had not been cleaned out for several days contained a thick layer of mosquitoes, flies, moths, and other insects. The dead anopheles in this trap amounted to several thousand. In an average of 6 traps daily for 60 days over 37,000 anopheles were caught and counted. The largest catch on record in one night, in one of these traps, was 1,018 anopheles."

Bug Traps.

A bug trap was, in former days of less evident hygiene in India, held to be a part of the officially provided equipment in jails and hospitals. This consisted of a piece of wood of about 18 inches in length and 2 inches in thickness divided longitudinally into two halves. The lower half was semi-perforated with holes. The upper half could be adjusted so as to form a lid to prevent exit of bugs (during the act of removal) which were induced to take shelter by the trap being placed in likely places such as beds. On the same principle, a tropical helmet placed in likely positions forms an excellent trap, as bugs approve of shelter to be found in the corrugated ventilation ridge round the rim. They can be effectually dealt with by holding the helmet over burning sulphur.

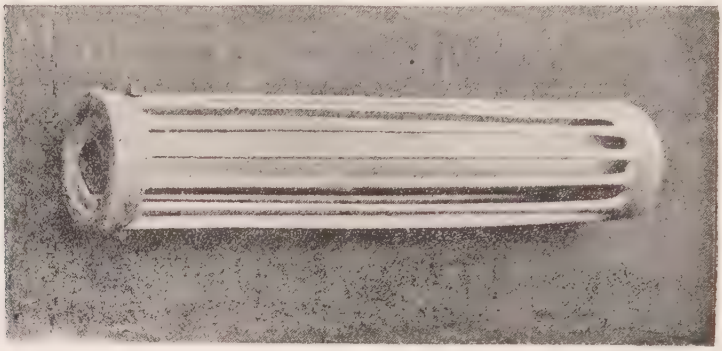
Insect Traps.

Dr. Hindle gives in the *Proceedings of the Cambridge Philosophical Society*† the details of a simple flea trap in use by the Chinese. We

*Insect Trap. Local Invention, designed chiefly to catch Mosquitoes by means of Human Scent.—*Canal Record*, 1914, Feb. 11, Vol. 7. No. 25 pp. 239–240.

†Hindle (E.). A Chinese Flea-trap.—*Proc. Camb. Phil. Soc.*, 1913. Vol. 17. Part 3.

reproduce the photograph of the arrangement and its description, as it may prove a useful adjunct in plague prevention :-



(Reproduced from the *Proceedings of the Cambridge Philosophical Society.*)

"The apparatus consists of two pieces of bamboo one inside the other. The outer bamboo is about one foot in length and 2½ inches in diameter and is fenestrated in the manner shown in the accompanying photograph. The inner bamboo is of equal length but only about an inch in diameter, and is kept in position within the former by means of a short wooden plug.

"The manner in which the apparatus is employed is as follows :—The two pieces of bamboo are first separated by removing the wooden plug. The inner bamboo is then coated with bird-lime, or some similar sticky substance, and put back in position within the fenestrated bamboo. The function of the latter is protective and prevents the sticky surface from coming in contact with any large objects. The whole trap can now be placed under bed clothes, or amongst rugs, etc, and any fleas that get on to the surface of the inner bamboo at once stick to the bird-lime and are thus caught."

Bats as Mosquito Destroyers.

At a meeting of the International Institute of Agriculture in Rome, Dr. C. K. Z. Campbell recommended the introduction of bats into localities in aid of mosquito extermination efforts. He made a special building at a cost of £240 near the edge of a Texas swamp ; in this swamp 1¾ million cubic feet of sewage were daily allowed to flow. The case he dealt with was, therefore, presumably, one of nuisance from culices. He believes that each bat could consume in due course 500 mosquitoes daily ; and, as his bat population in due course increased from a few hundred to over 500,000, he concluded that the bats, during seven months, consumed 50,000,000 mosquitoes. Irrespective of this service, they produced 20 tons of guano which sold at £6 per ton.

As a commercial undertaking the arrangement was apparently sound ; and if the town concerned selected so inappropriate a method of sewage disposal, it is unlikely that human beings contested with bats the pleasure of living in the neighbourhood of the swamp. In inhabited areas, ordinary methods of mosquito reduction are not likely to be abandoned in favour of the introduction of 500,000 bats.

Crude Carbolic Acid as an Agent for destroying Mosquitoes.

Whilst employed in the Panama Canal Zone Dr. Orenstein* made

*Orenstein (A.) Ueber Rohkarbolsäure als Mückenvertilgungsmittel. —*Arch. f. Schiffs- u. Trop.-Hyg.* 1913. Dec. Vol. 17. No. 23. pp. 837–838.

the following experiment with crude carbolic acid as an agent for destroying mosquitoes. A square wooden frame without bottom was made, $1\frac{1}{2}$ meters in the side and 0·3 metre in depth. This was sunk to the level of its upper edge in swamps containing mosquito-larvae, so as to circumscribe an area containing water and vegetation, $2\frac{1}{4}$ square metres superficially, and having a cubic capacity of 0·675 of a cubic metre. By means of a glass syringe 100 cc. of crude carbolic acid was sprayed over the included area, and then samples of water were taken at short intervals to see if the larvae were dead. It was found that half-an-hour sufficed for this purpose. The experiment was then repeated at another spot with 60 cc. of carbolic acid only, and it was found that twenty minutes sufficed to kill all larvae.

The author's conclusion is that this is a serviceable method of destroying mosquito-larvae, where paraffin oil is not available and the water is not required for domestic purposes. A quantity of 200 cc. of crude carbolic acid would seem to be sufficient for 900 litres of water.

The solution of carbolic acid used contained about 20 per cent. of pure phenol.

The Employment of Larvivorous Fish in the Bismarck Archipelago as an Anti-Malarial Measure.

At the instigation of Dr. Ruge, the Government of New Guinea, after two failures, recently attempted to acclimatise larvivorous fish in the Archipelago.* In this third and successful attempt, four species of fish, *Galaxia scriba*, *Macropodus viridiauratus* (the Paradise fish), *Cassiops Galii*, and *Pseudomogul signifer* ("Blue eyes") were imported from Sydney. The fish were placed in glass vessels; and, in spite of the addition of fresh water and a water plant, *Valisneria spiralis*, the mortality was considerable; 50 per cent. of the paradise fishes died, but all the Galaxias lived. On arrival in Rabaul, the fishes were placed in a cement tank, where it is proposed to breed them and later to distribute them throughout the Archipelago.

The author fails to state how the fish were fed on the journey. Apparently, some form of cakes or biscuits was employed, which may not have been the food required by these fish. The late H. Thomas, I.C.S., Madras, in "The Rod in India," and in an official Report, made a suggestion as to transport of fish that may be useful to those who consider that in tropica countries, where mosquitoes are in plenty, Nature has not also provided, amongst others, sufficient voracious fish enemies. Long before Ross had demonstrated the rôle of the mosquito in malaria, Thomas had come to the conclusion that mosquito larvae formed excellent food for young fish during transport. For this purpose, he placed the larvae between layers of damp flannel, and was able to preserve them alive for periods which, in these days of steam transport, would suffice for most transfers from one tropical region to another. He was not content also with merely giving fish fresh water in their tanks, but advised oxygenation by agitation and the use of the bellows. A further method of feeding on which he placed faith was

*Börnstein. Zur Malariabekämpfung durch moskitolarvenfeindliche Fische im Bismarckarchipel.—*Arch. f. Schiffs- u. Trop.- Hyg.* 1914. Jan. Vol. 18. No. 1. pp. 21–26.

employment in the tanks of small varieties of snails—as to the continuous life of which there would be little doubt. These latter take readily to biscuits as food. Where transport of grown fish in bulk is not easily carried out, he strongly advocated another method peculiarly applicable in tropical climates—and this we quote verbatim :—

"Long before the commencement of pisciculture as a science Aristotle, and subsequently Mr. YARREL and Sir J. Emerson TENNANT (and I since find BUCHANAN also) had observed that 'the impregnated ova of the fish of one rainy season are left unhatched in the mud through the dry season, and from their low state of organization as ova, the vitality is preserved till the recurrence and contact of the rain and oxygen in the next wet season, where vivification takes place from their joint influence.' . . . It would seem therefore, that we need not seem disheartened with the objection that ice and moss are not as easily procured in India for the transportation of ova as in England. We have at least reasonable ground for entertaining the hope that in the tropical heat of India there is placed readily at our command an equally potent, much more simple, and much less expensive, means of suspending the animation of ova encased in some dried mire. There are numerous instances on record of vivified fish also, (of particular sorts) both as fry and as matured fish also, being thus kept alive during the drought, and the crocodile aestivates in the sun-burnt clay of a Ceylon tank in the same way as the alligator of the Mississippi hibernates in the frost. This interesting fact in natural history may be made of practical use in pisciculture, and the experiment would seem to be at least worth a trial. . . . . If the suggestion prove practical, pisciculturists of tropical climates would be at no disadvantage but rather the contrary as compared in this respect with the pisciculturists of Europe."

In a letter to the *Madras Mail*, under the title of "The Gourami" (probably written in 1884), the same acute observer of the habits of fish in the tropics made an observation which, in the absence of Ross's proof of the connection of anophelines with malaria, naturally attracted no attention at the time. It is one which however is now well worthy of investigation. Writing of Gourami (*Osphromenos olfax*) he said "my six little fry certainly take mosquito larvae very freely, though, they *show preference among the different sorts of such larvae*" (italics not in the original). This opens the possibility of certain fish fry preferring anophelines—a matter of vast importance in connection with the chronic discussion of the presence or absence of malaria following irrigation of crops in the tropics.

SANITARY LEGISLATION.

Larvae Cases.

Under this term, Colonial Medical and Sanitary Reports refer to instances of persons who harbour larvae of mosquitoes within their premises. The test of a charge made in the Police Courts is that larvae of mosquitoes were actually found by an Inspector. This form of ruling is passed from Administration to Administration as suitable. Yet, in the hands of a clever lawyer an excellent defence could be made, and a lay sanitary subordinate be given a "bad time" on the subject of identification of larvae. A more generally useful ruling would be to define receptacles, and conditions under which water may exist on premises liable, *in the opinion of the local authority as advised by its Sanitary Officer*, to facilitate the breeding of mosquitoes. Instead of securing a fine on proof of existence of larvae, it would seem safer to insist upon removal of the inimical conditions of the premises within a time specified in each case by notice, and, in the event of failure, to allow the local authority to be in a position to recover the cost of improvement of a type preventing recurrence.

Vital Statistics in Plague Prevention.

A point of practical importance is disclosed in the reports received of the Ceylon plague epidemic. When the mortality rate in Sea Street appeared before the Health Officer, merged into the statistics for the whole town of Colombo, the rise in the death rate was not sufficient to arrest attention In the South of India this possibility is guarded against by the Plague Regulations requiring that in a municipality declared to be "imminently threatened" (and consequently classed for preventive measures as "under observation") the statistical returns shall be rendered weekly for wards or divisions with their respective populations. Under such circumstances, irrespective of plague usually starting in defined zones, any fluctuation readily attracts attention.

Rulings.

Uganda Protectorate.—Under existing Ordinances, the Uganda Protectorate has passed a ruling defining syphilis as a "dangerous disease." In this it has preceded a possible outcome of the Royal Commission on this subject—in Great Britain. A further excellent advance has been made in requiring a license supported by a Medical Certificate for places for the manufacture of soda-water and ice. Both efforts are in advance of existing conditions in Great Britain. We may, however, state that the licensing of such factories and their subjection to sanitary inspection was required in the Madras Presidency in 1897, under the then amended District Municipalities Act of 1884.

Sierra Leone.—In Sierra Leone (Bonthi and York Island) it has been ruled that no building should be proceeded with unless the site be approved by the Medical Officer of Health. The next effort should certainly be to require that plans of intended buildings be also approved, *before* their erection is commenced.

TREATMENT OF WASTE.

Small Rubbish Incinerators.

Incineration of the destructible matter of the rubbish of communities is an ideal constantly held in mind by the sanitarian in the tropics, not only in reference to the getting rid of microbe bearing materials and matter suitable for the breeding of flies as "carriers," but to gain that economy in transport which conveyance to areas distant from dwellings forbids. The large patent incinerators of various patterns, fitted with forced draughts and labour-saving devices with more or less success, meet requirements not only of rubbish, but, to some extent, of excreta disposal. Such expensive installations are however out of the question for small communities; and there is, consequently, a constant striving to find some cheap form of incinerator that will fulfil the needs of villages, camps, jails, hospitals, etc. Hence, from time to time, a new "small incinerator" is discovered, but is put aside after so short a run of popularity as to prompt the question whether small rubbish incinerators have not greater limitations of their range of utility than is generally recognized. The truth would seem to be that if forced draught, added fuel, and labour-saving accessories be omitted, it is not so much a question of this or that pattern of incinerator which decides the selection, as the character of local rubbish in respect to richness in destructible matter, and the climatic conditions which tend to collection in a wet or fairly dry condition. For example, in Bombay City, with a type of incinerator (the "Garlick") used some years back, it was found that rubbish when fairly dry could be consumed at 120·4 cartloads per day, but when wet this decreased to 84·2 per day. In short, whilst bricks can be made without straw, water cannot be evaporated without the attainment of definite heat, and this must be attained before incineration can occur.

A good example of a small incinerator being approved in one locality but being regarded as useless in another is found in a paper by Dr. Angus MacDonald, Health Officer, Kingston, Jamaica, in the February number of the *Journal of State Medicine*.* He adopted a form which was used on the West Coast of Africa. From his description it was of the type sanctioned by the Gold Coast Government in 1910, which superseded the so-called Elmina domed-shaped pattern. It possesses a chimney 15 feet in height, sloping half bars, a feeding door at the upper end of the slope, and suitable details as to air entrance. He found however, as the local rainfall was inconsiderable, rubbish burnt just as quickly and effectually in the open air. Dr. MacDonald describes the burning of Kingston rubbish at the edge of marshy land he is desirous to fill, and then the classing of the unconsumed debris, so that the larger miscellaneous matters such as worthless bottles, tins, scrap iron, bricks, etc. should form the bottom layer of the deposit: on this layer, he superimposes the earthy and, finally, the small and hard debris. As a result, in a rubbish dumping site he has no flies, and the breeding of stegomyia is stayed by the judicious step of quickly burying on the bottom layer receptacles that might contain water.

* MacDonald (A.). Sanitary Conservancy in Kingston, Jamaica.—*Jl. of State Med.* 1914. Feb. Vol. 22. No. 2. pp. 112-120.

The latest addition to small incinerators is one known as the "Griffith." It is being used within the Corporation limits of the City of Madras. The plans show a circular brick chamber 3 ft. 7 in. in diameter, having a wall 4 ft. high covered in by a dome of 1 ft. 9½ in. in radius. The hearth has three superimposed round iron grids, separated by intervals of nine and eighteen inches; the object of this is unstated, but presumably, draughts might be favoured if the bulky and less consumed portions were retained on the uppermost grid, whilst the smaller are allowed to pass by gradation to the two lower instead of choking voids in the main chamber. An iron chimney is fixed in the centre of the dome, and is to vary from 15 to 25 ft. high, according to distance from habitations. Loading is effected through an iron door in the dome. With the exception of the grate, therefore, the incinerator is similar to well-known types. There is no provision for a shelter shed for rubbish pending incineration, which would seem essential during the wet season. It is, however, in the direction of working that speciality is sought. It is held "if the incinerators are to work properly a system of careful sorting and screening should be laid down and insisted upon." It is stated that one of these small incinerators will consume from 12 to 15 cartloads, of 35 cub. ft. each, per day—32 cub. ft. being, we suggest, probably the real average. The possibility of economy in transport would, therefore, largely depend upon whether habitations were scattered or concentrated, and whether roads were radial or there was a single main road; and, above all, whether a closer site to the town than ordinarily estimated can be secured. Taking the matter at its best, perhaps two-thirds of a two bullock-cart at, say, Rs.30 per cart per mensem, might be saved when contrasted with dumping within one mile of a town. Against this, however, must be placed the pay of three coolies to maintain the incinerator working, at a total cost of not less than Rs.18. In practice, the cartman will arrive at the depôt alone. The rubbish he will dump, but will not lift. Three coolies will therefore have to lift at least ten tons of rubbish (which in wet weather might weigh considerably more) *minus* the incombustible portions which must be sorted by manual labour, of a selective and therefore slow character, whilst the remnant is to be lifted an unstated height, and passed through an expanding screen. The screened material is then to be collected and burnt, whilst the rejected material is to be placed in neighbouring hollows. Lastly, if faecal matter occurs in the rubbish, it is to be separated out. The Madras city coolie sweeper is by no means a stranger to the occurrence of faeces amongst rubbish. He is quite willing not to see it, but it will probably be found quite a different matter when he is asked to separate it out. This would be the work of the toties or scavenger caste, who are more expensive office-bearers than the type of coolie who handles rubbish. Putting aside this difficulty, the chances are that if a Municipality possesses sweepers sufficiently conscientious, with occasional supervision, to deal thus in detail with rubbish, few would be found physically fit to deal daily throughout the year with the weight of rubbish in the manner indicated. As the whole success of the scheme would depend upon sites close to dwellings being selected for incineration, any failure to completely burn the daily loads would favour the breeding of flies as "carriers."

As already indicated, the claims for special efficiency of the "Griffith" incinerator rest not so much upon its pattern as upon the introduction of separation and screening involving repeated handling, which would introduce several uncertain factors in economy. On the whole, therefore, when proximity to dwellings of a rubbish disposal site demands destruction of material in incinerators not employing forced draught, and dealing with estimated quantities, it would seem that economy is more likely to be attained by Dr. Angus MacDonald's method of using the incinerator (with or without protection by sheds, according to climatic conditions) in a dumping ground, there being no further handling than required in the classification he describes. In filling marshes by his method the use of light rails would facilitate work.

SANITARY WORKS.

To "Meet Changing Views."

About twenty-two years ago, the Municipality of the town of Mandalay (present population 138,299) considered the introduction of a public water supply a necessity. With the modesty of a young Corporation, they thought of utilising the source of supply of King Thebaw's Fort moat. It was not difficult to show that, sanitarily, this was not a desirable source; so an "authority" evolved a very reasonable subsoil water scheme situated near the river. But another authority held that this water was too hard, and specially urged that to Burmans the soft water of the Irrawaddy was peculiarly acceptable. Thereafter, another authority appeared, who pointed out that the plant for pumping from the Irrawaddy, on the first monsoon after its establishment, might be left high and dry—by a river never to be relied upon two years on end to abide by a previously selected course. But, in due time, another authority appeared, who showed how absurd it was to go to the enormous expense of long pipe lines necessary in pumping from the river or the subsoil source in its proximity, seeing that bored wells within the town area would give all that is required. Then the other inevitable man appeared, who held that the bored well theory must be received with certain limitations not applicable to the subsoil scheme and that, in any case, as power for pumping would imply a perpetual charge upon the municipality, both schemes should be avoided if possible, but advised that before any decision was arrived at, an exploration of the neighbouring hills catchment areas should be made to ascertain whether a gravitation scheme was feasible. When this was prepared, an authority found one of the suggested sources of supply undesirable; and the latest intelligence on the matter is that Mandalay will probably revert to a *new* bored well scheme. Throughout these twenty-two years these schemes have meant much special labour, not only in surveying various areas but in preparation of estimates.

Considered from the point of life-saving, the delay is to be deprecated; and accordingly it was a subject in which the Government of Burma felt it necessary ultimately, in the public interest, to insist upon a decision being arrived at. But, putting lapse of time out of question, the facts bear with them a moral as to sanitary administration, which it is well for those serving in the tropics to hold in mind. It is that, when the water-supply of a large town is under consideration, not this or that man's inspiration and selection of a source should alone be brought to notice; but that all possible schemes should be carefully discussed by the sanitary and engineering authorities, after examining the areas concerned in company; so that, when differences of opinion arise, and where more than one scheme may appear to have sanitary and financial merit, at least an approximate estimate should be made. In this way final answers can be given in reply to the suggestions or objections by sanctioning authorities. This method may be held to imply unnecessary waste of time and labour; but, on the other hand, it must be remembered that saddling a town with a hasty and ill-conceived scheme, for which the people may be taxed for thirty or more years, may be as bad, sanitarily, and often worse.

financially, than if 22 years were allowed to elapse in spasmodic action.

It would be a mistake to conceive that Mandalay stands convicted of unusual conduct. Our details could be easily capped by references to towns in Europe; nor is such delay confined to the knotty points of sanitary schemes, as witness the contentions as to designs both under the French and the Americans, which preceded construction of the Panama Canal.

Our object in referring to this instance is that such circumstances are peculiarly liable to occur in our tropical possessions; for the simple reason that the men who propose or who support this or that scheme are liable to transfer from localities dealt with, or are victimized by tropical diseases and disappear temporarily or permanently; when, as a sequel, there becomes applicable the proverb *autres temps autres moeurs*. Nor is the variability of official opinions the sole point to be considered; there is the important matter, in deciding upon the outlay of public funds, as to relative importance of various schemes for sanitation. An influential member of a Local Body is at all times capable of focussing attention on a favourite scheme to the confusion of real sanitary urgency.

Hence, we regard the following recent Order of the Government of Madras as one that might with advantage be imitated in principle by other sanctioning Authorities dealing with sanitary administration in the tropics; albeit that there is an undesirable loop-hole for the avoidance of the spirit of the ruling in the phrase "in consultation, if necessary, with the District Medical and Sanitary Officer, or the Sanitary Commissioner." It should, however, be added that as the phrase is probably meant to admit of an official convenience, solely in respect to a class of schemes where it is self-evident no second consultation as to order of urgency is requisite, the loop-hole is likely to be a danger only in the absence of a ruling correctly co-ordinating sanitary with sanctioning authorities:—

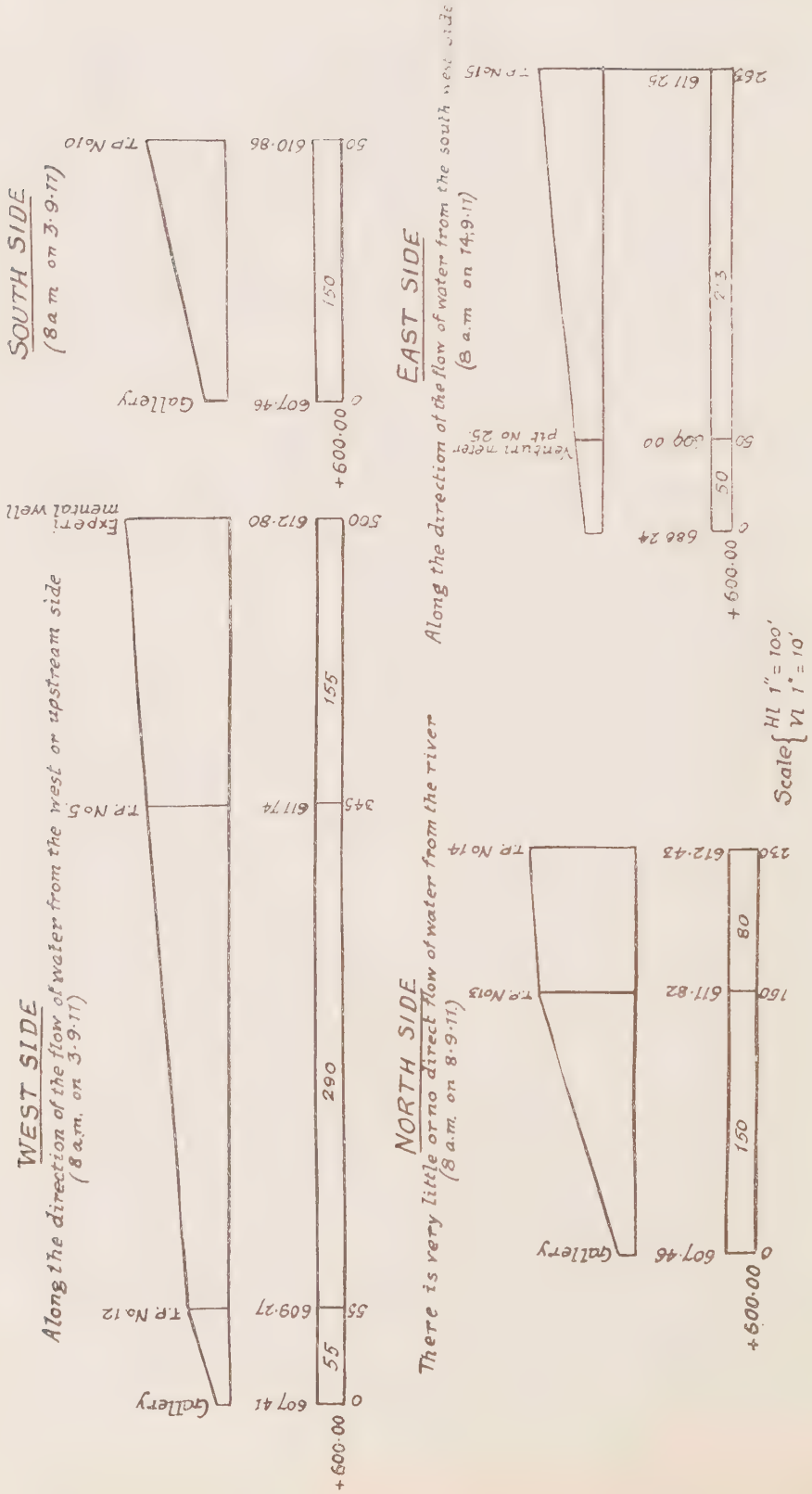
"Since 1908 the Government have been in a position to make substantial grants to local bodies for the purpose of enabling them to carry out sanitary projects which cannot be financed from the resources ordinarily available. The annual distribution of the assignments allotted for this purpose presents considerable difficulties and it is not always easy to decide between the various competing claims. The original practice was to restrict assistance to fully matured schemes or works of a permanent authority. This restriction was subsequently modified so as to permit of applications being made in respect of schemes which had reached such a stage as to make it reasonably certain that estimates would be duly sanctioned by the commencement of the year in which the grant was payable. All applications for assistance from the sanitary grant are due with Government not later than the 1st October and instructions have recently issued laying down that advance lists of proposed projects shall be forwarded to the Sanitary Commissioner in order to enable that officer to arrange his tours of inspection so as to permit of any local examination which he may consider a necessary preliminary to forming his opinion on the merits of particular claims. As the Government ordinarily defer passing orders on the distribution of the grant until they are in possession of the Sanitary Commissioner's opinion, this procedure should make it possible to deal promptly with the applications put in without risk of making assignments in aid of ill-considered proposals. But while the Government are thus placed in a position to judge whether individual schemes are deserving of assistance, the original selection depends upon the local body concerned and there is frequently no guarantee that sufficient

consideration has been paid to the relative importance and urgency of the various local requirements in regard to sanitation. This difficulty has been met in some cases by framing a definite and comprehensive programme of works intended to be spread over a series of years, the various items being arranged in order of priority. The Government desire to commend this procedure to all local boards and municipal councils. If the question of priority is carefully worked out in consultation, if necessary, with the District Medical and Sanitary Officer or the Sanitary Commissioner himself, the preparation of estimates can be taken up in order of urgency and the annual applications to Government for assistance from the Provincial grant will form part of a systematic plan of operations instead of being based upon the changing views of those who happen to be in authority at the season of the year when it becomes necessary to address Government. The action taken with reference to this advice should be specially noticed in the annual administration reports of local boards and municipal councils."

Infiltration Galleries.

Given a pure and readily permeable subsoil tapped for its water contents by a gallery, the sanitary engineer has at disposal a method of water supply which may, in the presence of sufficiency of yield, get rid of the necessity for storage reservoirs, filter beds, and perhaps even a balancing or service reservoir. If the position of the gallery is such that sufficient head is at disposal to command the town, to these economies he may add the absence of recurring charges for pumping by arranging a gravitation system. Hence, in tropical countries an infiltration gallery with a rich supply of water is ordinarily a welcome and cheap addition to sanitary effort. Not uncommonly, favourably placed galleries may yield 120 gallons or more per 24 hours per square foot of bottom. Ordinarily, such schemes do not present many engineering difficulties, and it is therefore interesting to find conditions which at times militate against their full success.

In a Report by Mr. Gnanaprakasam, Asst. Sanitary Engineer, (embodied in Madras Govt. Order No. 42M dated 6th Jan. 1914) an explanation is forthcoming of difficulties which have been encountered with the water supply of the town of Tirupati, for an estimated population of 24,000. This is a gravitation system from an infiltration gallery in the right bank of the River Kalyani, intended to tap the subsoil water before its flow to the river. The lead to the service reservoir being over 36,000 feet, and the municipality being impecunious, the sanitary engineer of the period in evolving the scheme advised resort to the cheap expedient of cement instead of cast-iron pipes; the pressure anticipated being inconsiderable. This effort towards economy, however, very shortly resulted in trouble. The cement pipes of nine inches diameter necessarily were rich in joints, and, in spite of ordinary care in making them watertight, roots of trees soon made their way into them; so that, by blockage and leakage, the total flow was diminished by 73 per cent. This also resulted in a heavy yearly charge for clearing. Even when this was accomplished however, the pipe line was found not to give the calculated yield, which in this case was, in a gallery 330′ × 6′, only of the modest amount of 250 gallons per minute. There is no reason to doubt the care with which the original tests of the yield of the gallery had been made, or that due deductions were made for dry years; yet, when it was anticipated that in a dry year the water would stand in the gallery at not less than 6 ft. 8¼ in. above the outlet pipe, it was found in practice


WEST SIDE
Along the direction of the flow of water from the west or upstream side
(8 a.m. on 3·9·11)
Gallery
T.P. No. 12
T.P. No. 5
Experimental well
+600·00
607·41
609·27
611·74
612·80
0
55
345
500
55
290
155
SOUTH SIDE
(8 a.m. on 3·9·11)
Gallery
T.P. No. 10
+600·00
607·46
610·86
0
50
150
NORTH SIDE
There is very little or no direct flow of water from the river
(8 a.m. on 8·9·11)
Gallery
T.P. No. 13
T.P. No. 14
+600·00
607·46
611·82
612·43
0
160
230
150
80
EAST SIDE
Along the direction of the flow of water from the south west side
(8 a.m. on 14·9·11)
Venturi meter pit No. 25
T.P. No. 15
+600·00
686·24
689·00
611·25
0
50
269
50
213
Scale { Hl 1" = 100'
Vl 1" = 10'

to be depressed to the same level; so that, as the first 1000 feet of the discharge pipe were laid flat, in trust of enough head to overcome resulting friction, discharge was so greatly diminished that, to secure flow, intermittency of supply was necessary to allow of the gallery filling up to the required level.

The circumstances under which diminution of yield below anticipation was brought about have been worked out carefully by the reporting officer. Put briefly the difference in yield is found to depend largely upon the fact that, in construction, the outlet pipe pierced a not readily permeable ridge of mixed clay and kunker (lime nodules); so that leakage occurred along the course of the pipe from what proved to be an unexpectedly restricted subsoil area for supply of the gallery. The configuration dealt with was of an unusual nature; in calculating the yield by pumping tests with the gallery wall unpierced at that particular site, it could not have been foreseen by the sanitary engineer concerned that he was dealing with a mere basin of ten acres in area instead of, as is usually the case in such supplies, a subsoil that might be free of marked obstructions for many miles. The Report shows that, except for a small space in the north-west, the ridge pierced by the outlet pipe is continuous on the north, south and east. In the north-west the sandy basin was continuous with the bed of the River Kalyani at about $1\frac{1}{2}$ furlongs from the gallery; so that, on depression of the water in the ten acre basin, there resulted a flow *from* the sandy bed of the River Kalyani instead from the subsoil water on its way to the bed, and, in this manner, the main source of water supply was derived.

The moral would seem to be that in tapping subsoil waters by infiltration galleries, where pervious strata are found with grades of impervious strata, the possibility of a basin-like underground reservoir such as found in this case giving deceptive results must be held in mind; and therefore, irrespective of confidence inspired by yield of water during experimental pumping, the configuration of the supplying subsoil should be ascertained by free use of pits and boring in definite directions.

The remedies proposed are an extension of the gallery by 800 ft., so as to cut the course of the subsoil water at right angles outside the limit of the constricting clay and kunker ridge, the filling in of the ridge with puddled clay at the point cut for the outlet pipe, and the substitution of cast-iron for the cheaper but inefficient cement pipes.

In text books, there are standard diagrams of the drainage cones of subsoil waters, but it is rarely that the facts are obtainable from plotted observations. We hence invite attention to the curves as illustrated in the Report :—

Mr. Gnanaprakasam thus explains the curves :—

"The above curves show that the gallery receives its main supply of water from the west and south sides. The yield on the north side is very poor: because a sharp curve in the cone of depression generally indicates that the quantity of water drawn is greater than the rate of the yield. It will also denote therefore a poor yield or a very slow rate of flow in the subsoil water owing to increased resistance created by the compactness of the soil. Similarly, a flatness in curve along the direction of the flow of water or on upstream side indicates a proportionate increase in the flow of water or yield. But the flatness in curves on the down stream side should not be taken into consideration. These curves are generally flat on account of the fall in hydraulic gradient on the down-stream side and the yield should be usually limited."

Book Reviews.

Ryan (J. Charles). [L.R.C.P.I., L.M., L.R.C.S.I., &c). **Health Preservation in West Africa,** with introduction by Sir Ronald Ross, K.C.B., F.R.S.—xv+96 pp. with 1 plate. 1914. London: John Ball & Danielsson, Ltd. [5*s*. net.].

The author of this booklet has dedicated it to Sir Ronald Ross, who, in an Introduction, makes the following statement:—"Books like this one therefore fill a most important rôle as regards the development of tropical countries, in that they enable every one to help himself if he chooses to do so." He adds that Dr. Ryan's book "is full of wise hints and of information useful to every one."

It is rarely that books intended for the guidance of Europeans in tropical countries take note of more than therapeutic measures, supported by a few commonly recognized rules of personal hygiene. They fail to take the reader into the daily routine of life and warn him of incidents in themselves trivial, but which, if correctly interpreted, may imply the difference between a breakdown and the retention of vigorous health. In such matters, the author is eminently successful, with the result of placing a concise and useful guide at disposal. Thus, after duly insisting upon the usual preventive measures against insect-borne and vegetable parasitic diseases, he requires attention to many small but important details of personal hygiene under "camp sanitation." He insists upon all water for domestic use, including that for the bath and the washing of vegetables, being boiled. He warns as to night soil pits being in the vicinity of the water-supply, "be that a well or a river"; but, probably feeling the difficulty as to the influence of varying perviousness of different strata, he prescribes no distance.

From dwellings he would give a distance of 300 yards, and states the dimensions as 3 feet wide, 6 or more feet long, and 1½ feet deep. This he requires to be used both for receipt of the contents of pails of Europeans, and direct as a latrine by servants and other natives employed in the compound. It is obvious that this method, which is common in West Africa, is susceptible of improvement. It would be impossible for a trench of this width to be used in comfort by the natives, whilst it risks exposure to flies of an unnecessarily large area in the event of careless use of earth covering.

In his suggestion for protection against mosquitoes, he refers to a comfortable and "portable mosquito-proof room" designed by Mr. Sidney Smith. Evidently, these rooms are not much known in West Africa, but portable mosquito rooms were in use in Burma in the 'seventies. Indeed, in that country, without some such arrangement in camp during the wet season, the retention of any light would be impossible on account of swarms of uninvited insect guests. He warns against using tins filled with water in which the legs of meat safes are placed with the object of preventing attacks by ants, lest, by neglect of adding a larvicide, they become breeding places for mosquitoes. In India, this difficulty is got rid of by placing round the legs of the meat safes a small band of cotton cloth soaked in country lamp oil—crude castor oil. We have never tried the experiment of using it in these tins, but think it possible ants would not care to pass to the meat safe legs through a dry mass of powdered borax. They certainly keep clear of shelves sprinkled with borax.

The author is a believer in alcohol within restricted limits, and specially warns against the habit of "nipping," which he says "as a result of the great heat and constant thirst becomes a fascination." In this sentence, the author strikes a great truth of far reaching consequences in the tropics. It is not, in our observation, the man who takes a moderate amount (more especially if this be of definite measure) of alcohol with his meals who tends to become the victim of alcoholism in the tropics, but he who when thirsty and prostrated by heat, *between meals,* chooses to partake of fluids which he dilutes with alcohol. Most heartily do we agree with the author's strenuous warning against that sitting "out in the open" in the evening which so frequently follows the exertion of lawn-tennis in the tropics, when those concerned fail to change clothing which must be more or less

permeated with perspiration. He thus drives his warning home: "In the whole gamut of precautions there is none more sonorous than the note of warning against this practice, which, countless times, has been the exciting cause of some latent malady more or less serious." The author fails to mention or to discuss typhoid fever, presumably on the ground that this is not a disease of West Africa. If there is such immunity at present, there is no reason why it should be held to be of a permanent nature.

W. G. King.

FÜLLEBORN (F.). **Ueber eine medizinische Studienreise nach Panama, West-indien und den Vereinigten Staaten.** [On a Journey to Study Sanitation in Panama, the West Indies and the United States.] —*Beihefte z. Arch. f. Schiffs.- u. Trop.-Hyg.* 1913. Vol. 17. Beiheft 7. pp. 1-65.

In the summer of 1912 Dr. Fülleborn was commissioned by the Institute for Tropical Diseases in Hamburg to study the sanitation of the Canal Zone, and also, if time permitted, to visit the West Indies, and finally to represent his country at the International Congress of Hygiene and Demography at Washington. The expenses of this instructive journey were defrayed by the Hamburg Municipality.

The first part of the paper is concerned with a description of the local conditions prevailing in the Canal Zone. Dr. Fülleborn has much to say in appreciation of American methods, especially of the admirable discipline on duty and the feeling of good fellowship when off duty so evident amongst all ranks employed in the great work.

A large number of vital statistics and other figures bearing on the work were collected, of which a few may be quoted. The Zone, as is well-known, has been free from yellow fever since 1906, and the death rate has correspondingly fallen from 49·94 per mille in that year to 20·49 per mille in 1912. The cost of the sanitary measures adopted by Surgeon-General GORGAS works out at less than 1 per cent. of the whole expenditure on the Canal, or at about 1 cent a head for every employée. The sanitary service consists of 1,373 persons, of whom about 100 are medical men.

Pneumonia accounts for the greatest number of deaths; malaria as a cause of death has now taken a second place. Of the races employed in the Canal Zone the most susceptible to malaria hail from regions relatively free from that disease, such as the North of Italy and Spain.

The negroes exhibit a relatively high immunity to malaria and black water fever, to which Europeans of non-malarial countries employed in the Zone are especially prone; as DEEKS and JAMES have often declared, the relation between malaria and blackwater fever in Panama is an obvious one. Quinine prophylaxis finds little favour in the Isthmus, although quinine in soluble form is provided by the authorities and is to be found in every restaurant; it is generally taken by the workers as a stimulant or as an appetiser.

Anti-mosquito measures.—*Anopheles albimanus* is the chief carrier of malaria; a special study has, therefore, been made of its habits. It has been found breeding in every accumulation of water, in running streams, brackish water, bilge water and even in crab holes. An anti-mosquito campaign is conducted throughout the year and is restricted to the immediate surroundings of dwelling houses.

The responsibility for these anti-mosquito measures falls on the "Sanitary Inspection," the field of whose activity ranges over an area of 100 English square miles, containing seventeen districts in charge of as many well paid and intelligent sanitary inspectors. Each sanitary inspector has a brigade of coloured workers at his disposal.

The anti-malarial campaign is conducted under the following headings:—

(*a*) Drainage of anopheline breeding areas, wherever practicable.

(*b*) Clearing the bush and thick grass.

(*c*) Destruction of larvae by chemicals or by larvivorous fish.

(*d*) Control of the screened houses* and destruction of adult anophelines who have managed to gain entrance.

*For the value of screening as an anti-malarial measure in the Canal Zone see this *Bulletin*, Vol. 3, No. 3, p. 150.

Petroleum and a carbolized preparation known as "Larvicide" are the substances most efficient as larvicides; 67,000 gallons of raw petroleum, diluted with 5–10% of "Larvicide," at a cost of $1.1 per 42 gallons, were used during 1912.

Yellow Fever.—Since 1906 no case of yellow fever has been reported in the Canal Zone, although in spite of an energetic campaign Stegomyia is still abundant in the town of Panama, as also in the neighbouring town of Guayaquil, which constitutes an ever present menace as a reservoir of yellow fever infection.

Plague.—Rats are poisoned by phosphorus and arsenical preparations; little reliance being placed on different forms of bacterial viruses. The best results have been obtained by constantly changing the mode of laying the poison.

Pneumonia.—The ravages of pneumonia amongst the negro population are especially noticeable. In 1912 the mortality from this cause was six times greater in the coloured than in the white population.

Typhoid.—All races in the Canal Zone are proportionately liable to typhoid; the case mortality is about 14·7 per cent. Dysentery, tuberculosis, relapsing fever, yaws, ankylostomiasis, rectal bilharziasis, beriberi and pellagra are all to be reckoned with, but play little part in the mortality returns.

The report concludes with a description of the workmen's dwellings, sanitation, water-supply, and commissariat. It is interesting to note that, in pursuing their policy of thoroughness, the Americans have built and equipped the Tivoli Hotel in Ancon, where the prices are moderate and which is a profitable commercial venture. Encouraged by this experiment they are building a larger and more luxurious structure for the accommodation of winter visitors.

Dr. Fülleborn paid a visit to New Jersey where he witnessed, in the salt swamps near Elizabeth, a campaign against the New Jersey mosquito. He also found time to study the methods of the Hookworm Commission in the Southern States. After paying a flying visit to Jamaica and Havana, he returned to his duties in Hamburg at the end of October 1912.

Dr. Fülleborn is very appreciative of all he saw of American methods. and his report is worthy of serious study, crystallizing, as it does, in a short space all the available information. It is compiled throughout with the thoroughness and accuracy so characteristic of the author.

P. H. Bahr.

SCHÜFFNER (W.). **Tropenhygiene und ihre Probleme.** [Tropical Hygiene and its Problems].—Vortrag . . . in der Universitäts-Aula zu Amsterdam am 21 Januar 1913 auf Einlandung des Studenten Vereins *Secties voor Wetenschappelijken Arbeid.*—35 pp. with 1 diagram. 1913. Amsterdam: Printed by J. H. de Bussy.

An interesting account of the measures taken, under the author's superintendence, for improving the health of the native workers on a large tobacco-plantation at Deli, Sumatra, employing nearly 7,000 hands, over a period of 15 years extending from 1896 to 1911. At the commencement of this period, the mortality on the plantation averaged 74 per 1,000 per annum, with wide fluctuations according to season, so as to cause great difficulties in the supply of labour; but by the end of the period it had been brought down to 11·5 per 1,000 per annum, which the author regards as a very satisfactory result for the tropics.

The chief causes of the previously existing high mortality were found to be (1) amoebic dysentery, (2) cholera, (3) ankylostomiasis, and (4) beriberi; and these were combated in the following ways:—Dysentery was got rid of by a system of providing all the workers, while at work in the fields, with an unlimited supply of freshly-brewed tea, so that they might be under no temptation to drink cold water. This arrangement is much appreciated by the Javanese coolie, who prefers tea to water as a beverage, when he can get it without trouble to himself. Cholera and enteric fever were proved to be more due to the contamination of food by flies than to impure drinking water, and orders were therefore issued

for the consumption of all meals while hot and at regular intervals, what remained over being regularly thrown away. Messes of cold boiled rice, set aside for future consumption, form excellent media for the growth of bacteria in the tropics. This precaution was immediately followed by a great reduction in the number of outbreaks of cholera and typhoid fever. Ankylostomiasis was dealt with by the regular administration of anthelmintics to the whole corps of workers, oil of chenopodium being found the most convenient agent for the purpose; while beriberi ceded to the regular issue by the administration of supplies of rice only partially decorticated, according to the native fashion, by bruising in a mortar. The result is a great economy to the management of this large concern in the recruitment of native labour, the death-rate being less than a sixth of what it used to be.

When we proceed to ascertain which of the measures employed by the author were chiefly operative in producing so marked a reduction of mortality, it cannot be said that the evidence brought together enables them to be readily distinguished. Thus, he holds that cholera and typhoid were more fly-borne than water-borne, and that cessation of the use of cold cooked food was followed by quick reduction; whilst they admit that the water supply near habitations was subject to pollution. Unfortunately he does not state whether the system of rubbish and night soil conservancy underwent a change in the period concerned, or whether liability to pollution of waters near habitations was diminished. Again, in judging of the effects of tea drinking during labour in the fields, to which they assign the prevention of dysentery, no criterion is advanced as to the extent and nature of pollution of sources of water supply accessible at that time to the labourers. Hence, it is quite possible that the chief source of cholera, typhoid, and dysentery was not near the habitations, (and thus more immediately than in the fields connected with flies as "carriers,") but in the water supply available during work hours in the fields; and that, consequently, the institution of tea drinking (that is to say, the use of boiled instead of unboiled water) in the fields alone sufficed to check these diseases. The position is analogous to the circumstances of jails in certain parts of India, where hot cooked food protected from flies is served within the jail; but trouble is, nevertheless, liable to arise when the prisoners are worked for cultivation in its immediate surroundings, where irrigation channels and other unprotected sources of water supply may be available. In such cases, the gangs of prisoners are required to carry with them boiled or other purified water from the jails precincts, but careless supervision by guards at times results in their using contaminated water supply.

It would also have aided the gauging of the effect of the wholesale treatment of the labourers for ankylostomiasis, had it been stated whether night soil collection and disposal remains unchanged since 1897.

The absence of details such as suggested by us must, unfortunately, leave it undecided to what particular effort the results were chiefly due; but the reduction of mortality secured is none the less a solid fact, which must have been gratifying alike to the authors and to the owners of the estates—who must have profited financially by their sound advice.

W. G. K.

MENSE (Carl). **Handbuch der Tropenkrankheiten.** 2nd Edition. Vol. 2. —xv+747 pp. Imperial 8vo. With 126 illustrations in text, 14 black & white & 6 coloured plates. 1914. Leipzig: Verlag von Johann Ambrosius Barth. [Paper covers 40 mk., bound 42 mk.]

The second volume of Mense's well-known "Hand Book," which by the way is five pounds in weight, contains monographs on Applied Haematology in Tropical Diseases by Dr. V. SCHILLING-TORGAU (pp. 149), Tropical Skin Diseases by Prof. Dr. A. PLEHN (pp. 138), Worms and the Affections produced by them by Prof. Dr. A. LOOSS (pp. 202), Poisoning by Plants by Prof. Dr. F. RHO (pp. 100), Poisoning by Animals by Prof. Dr CALMETTE and Dr. L. BRUYANT (pp. 62) and Nervous and Mental Diseases in the Tropics by Dr. P. van BRERO (pp. 42). Half the text illustrations belong to LOOSS's article. Full bibliographies are given at the end or in

the course of each monograph. Prof. RHO's article includes pellagra. The book is well printed and very well illustrated. Detailed reviews of some of the articles will appear in later numbers.

A.G.B.

ERRATUM.

On p. 295 of No. 6 (Vol. 3) of this *Bulletin*, in a summary of a paper by DE ALMEIDA, it was stated that betanaphthol was combined in a *tabloid* with phenolphthalein and that these *tabloids* were to be manufactured wholesale. In each instance the word used should have been *tablet*, or some other equivalent of the Portuguese "comprimidos," the word *tabloid* being the registered trade mark of Messrs. Burroughs Wellcome & Co.

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The Director can be seen between 10 and 1; for a later hour an appointment should be made.

The Director will be glad to receive early copies of works or reprints on Tropical Diseases for notice in the *Bulletin* and for the Library To be addressed—Tropical Diseases Bureau, Imperial Institute, London S.W

(Telephone:—Kensington, 5188.)

BOOKS RECEIVED.

MAY (A.) [M.D., Principal Medical Officer, Northern Rhodesia.] Report on Sleeping Sickness in Northern Rhodesia to December, 1913.—British South Africa Company: Administration of Northern Rhodesia. 29 pp. 1914: Livingstone. Administration Press.

SILER (J. F.). [Captain, Medical Corps, U.S. Army], GARRISON (P. E.) [M.D., Passed Assistant Surgeon, U.S. Navy], & MACNEAL (W. J.) [Ph.D., M.D. Assistant Director of Laboratories, New York Post Graduate Medical School.] With the collaboration of A. H. JENNINGS, W. V. KING, V. C. MYERS, [A.M., Ph.D.], M. S. FINE [Ph.D.], O. S. HILLMAN, [M.D.], and others. Pellagra. First Progress Report of the Thompson-McFadden Pellagra Commission of the New York Post Graduate Medical School and Hospital.—iv + 148 pp. illustrated. 8vo. 1914. New York. [Price not stated.]

RYAN (J. Charles). [L.R.C.P.I., L.M., L.R.C.S.I.] Health Preservation in West Africa. With introduction by Sir Ronald ROSS, K.C.B., F.R.S.—xv + 96 pp. With 1 plate. 1914. London: John Bale, Sons & Danielsson, Ltd. [Price 5*s*. net.] (See *Review*, p. 392.)

ZAMBACO PACHA (Démétrius Al.) [(de Byzance.)] La Lèpre à travers les Siècles et les Contrées. (Anthologie).—xii + 845 pp. 8vo. 1914. Paris: Masson et Cie. [12 fr.]

FANTHAM (H. B.) [D.Sc.Lond., B.A. Cantab., A.R.C.S., F.Z.S.] & PORTER (Annie) [D.Sc.Lond., F.L.S.] Some Minute Animal Parasites or Unseen Foes in the Animal World.—xi + 319 pp. Crown 8vo. With frontispiece and 56 text figs. 1914. London: Methuen & Co., Ltd. [5*s*. net.]

SAVAGE (William G.) [B.Sc.,M.D. (Lond.), D.P.H.] The Bacteriological Examination of Food and Water. [Cambridge Public Health Series.]—x + 174 pp. Demy 8vo. With 16 illustrations. 1914: Cambridge University Press. [Price 7*s*. 6*d*. net.]

CANADA: DEPARTMENT OF AGRICULTURE. Report of the Veterinary Director-General (F. Torrance, B.A., D.V.S.) for the Year ending March 31, 1913.—110 pp. Royal 8vo. With 4 plates. 1913. Ottawa: C. H. Parmele, Printer to the King's Most Excellent Majesty. [No. 156–1914. Price 10 cents.]

UGANDA PROTECTORATE. The Handbook of Uganda. Compiled by H. R. WALLIS, C.M.G., Chief Secretary to the Government.—xix + 220 pp. 8vo. With 19 illustrations and 1 folding map. 1913. London: Published for the Government of the Uganda Protectorate by the Crown Agents for the Colonies. [Price 2*s*. 6*d*. net.]

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